International Conference on Education in Mathematics, Science & Technology

PROCEEDING BOOK

EDITORS

PROF. DR. MACK SHELLEY
PROF. DR. MUSTAFA PEHLIVAN
DR. WENXIA WU

ICEMST 2018

April 28 - May 1, 2018
Marmaris/ TURKEY

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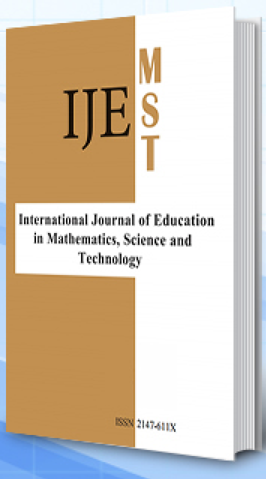

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Editors: Mack Shelley, Mustafa Pehlivan, Wenxia Wu

This book was typeset in 10/12 pt. Times New Roman, Italic, Bold and Bold Italic.

Internation Conference on Education in Mathematics, Science and Technology (ICEMST) Published by ISRES Publishing, International Society for Research in Education and Science (ISRES).

Includes bibliographical references and index.

ISBN : 978-605-67951-4-5
Date of Issue: October 01, 2018

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Ames, IA 50011-1204, U.S.A.

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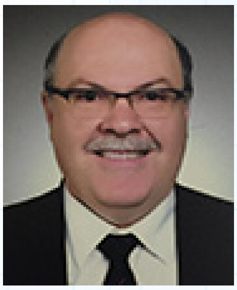
Keynote Speakers

Dr. David Treagust

Curtin University

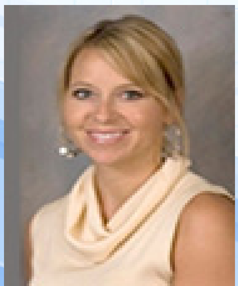
"The Importance of Multiple Representations for Teaching and Learning Science"



Dr. Mustafa Hilmi Colakoglu

Republic of Turkey Ministry of National Education

"Smart Schools and STEM Education"



Dr. Amy Hutchison

George Mason University

"Digital Possibilities in STEM Education"

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International Conference on Education in Mathematics, Science & Technology

Panels

Panel I: *Inquiry-based Learning: International Perspectives*

Moderator

Dr. Hakan Akcay

Panelists

Dr. David Treagust, (Australia) *Dr. Ayse Oguz Unver, (Turkey)* *Dr. Irina Lyublinskaya (Russia)*

Panel II: *STEM Reasoning and Learning*

Moderator

Dr. Hakan Akcay

Panelists

Dr. Amy C. Hutchison, (U.S.A.) *Dr. Mustafa Colakoglu, (Turkey)* *Dr. Kathy Malone (Kazakhstan)*

Panel III: *A Teacher and Explainer Professional Development Model to Increase the Effectiveness of Science Centers in Science and Society Communication and Science Education*

Moderator

Dr. Mustafa Colakoglu

Panelists

Dr. Fitnat Köseoğlu, Dr. Uygar Kanlı, Dr. Semra Mirici, Dr. Yasemin Özdem Yılmaz, Dr. Ceyhan İpekçioğlu, Dr. Alev Çetin (Turkey)

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INTERNATIONAL CONFERENCE ON EDUCATION IN MATHEMATICS, SCIENCE & TECHNOLOGY

Workshops

Workshop I: *The Importence of 21st Skills and Industry 4.0 in STEM Eduaction*

Dr. Sahin Idin
Scientix STEM Education Ambassador (Turkey)

Workshop Description: In the Workshop, it is going to be mentioned the relationship between 21st skills and Industry 4.0 in STEM Education. It will also be emphasized 21st skills and their importance for both STEM Education and Industry 4.0. Participants will be able to learn some significant points and the relationship between STEM Education and Industry 4.0 via some real exams within the scope of STEM Education.

Workshop II: *STEM Education Applications with 3-D Printers*

Dr. S. Ahmet Kiray, Mustafa Tevfik Hebebci, Ersah Akgul
(Turkey)

Workshop Description: In the Workshop, STEM Education Applications will be shown with 3-D printers.

Workshop III: *Playing with Mathematics in the Classroom*

Dr. Cara D. Williams
(United Arab Emirates)

Workshop Description: Tired of assessing students with worksheets in the math classroom? Then this workshop is for you! Participants will participate in demonstrations of how to make math classrooms more student-centered. Differentiating instruction by learning styles will be addressed for various grade levels. The workshop will be engaging, practical, and applicable for all K-12 math teachers.

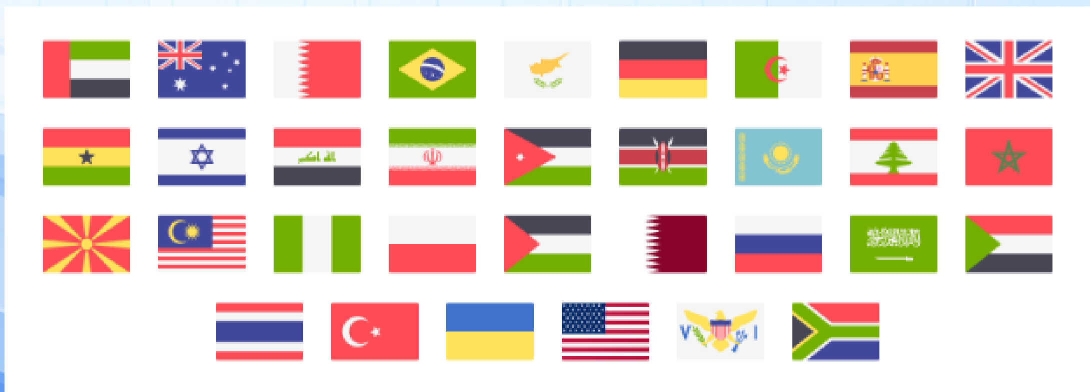
International Conference on Education in Mathematics, Science & Technology

Public Talks

The Public Talk: *Sexuality Knowledge of University Students*

Plenary Speaker: *Dr. Sinan Erten*

Participating Countries



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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 1-10

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Integrated Development and Assessment of Mathematical Modeling Practices for Culturally Responsive STEM Education: Lionfish Case Study

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University of the Virgin Islands

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University of the Virgin Islands

Risa GORDON
Virgin Islands Department of Education

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VI Institute for STEM Education Research and Practice

Abstract: Real-world problems often demand interdisciplinary solutions, and thus provide opportunities for cross-disciplinary instruction and learning within the mathematical sciences and STEM fields. Building on the vision of The Mathematical Sciences in 2025 (National Research Council, 2013) and with the motivation to prepare the students of the 21st century, interdisciplinary teacher teams are created to work together with students, university faculty, and community experts, towards building instruction around solving problems on locally relevant STEM challenges. The goal of this research program is to provide equitable access to quality STEM instruction for all students while using culturally responsive practices. Since 2014, with support from the National Science Foundation, in-service STEM teachers, students, and university faculty have been participating in year-long professional learning community (PLC) activities on STEM projects around culturally relevant topics such as lionfish population dynamics and control, water quality, and green home design. Based on the emerging local best practices with PLCs around interdisciplinary projects, these PLCs support the development of interdisciplinary knowledge and practices by students, teachers and the community for learning mathematical sciences and STEM, both in and out of school settings. Using the case of the lionfish project as an exemplar for culturally responsive STEM projects, we discuss how focused professional development sessions for teachers on the mathematical and scientific modeling of lionfish population dynamics and control using discrete, continuous and statistical methods furthered this development.

Keywords: Mathematical modeling, Assessment, Culturally responsive STEM education, Project based learning, Professional learning communities, Interdisciplinary mathematical and scientific practices

Introduction and Motivation

Despite the need, students in the Caribbean struggle to identify themselves with STEM related professions. As part of providing equitable access to high quality STEM education, educators are being asked to find ways to consider students‟ cultural and linguistic backgrounds and to develop a closer fit between their home culture and the culture of the school (Brown, 2007). This practice has been referred to as *culturally responsive teaching*. Research suggests that the academic achievement of ethnically diverse students can improve when they are taught through their own cultural and experiential filters (Au & Kawakami, 1994; Gay, 2000; Hollins, 1996; Kleinfeld, 1975; Ladson-Billings, 1995). Within inquiry-based teaching methods, it has further been suggested

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

that the motivation for inquiry should be grounded in personal interests, local social and environmental concerns, and community values (Freire, 2000).

In STEM fields, numerous calls have highlighted a need for a heightened emphasis on mathematical and scientific modeling, on more interdisciplinary practices, and on more integrated STEM projects for K-16 students (CCSS, NGSS, NRC, NCTM). Integrated STEM projects, in particular, are known to increase student STEM interest via authentic problem solving, collaboration, and the building of realistic models and solutions (Fortus et. al, 2005). Further, integrated STEM can develop better learning outcomes as students build their knowledge using the world around them (Satchwell & Loepp, 2002). Project-based learning (PBL) is known to be an effective method of STEM integration, with PBL building on a series of inquiry based, open-ended activities related to a thematic topic that can be approached from multiple disciplinary perspectives (Satchwell & Loepp, 2002). For example, population dynamics and control is a theme with deep running, cross-cutting ideas that can be used to build bridges across the STEM fields. Further, within the mathematical sciences, population dynamics allows students to experience mathematics from the perspective of another discipline, to be exposed to key ideas from complementary points of view (continuous and discrete, deterministic and stochastic,; exact and approximate), and to incorporate concepts and methods from data analysis, computing, and mathematical modeling, thereby meeting the recommendations of the MAA (2015). By emphasizing discrete population modeling techniques, educators can respond to the recent advances in the computational sciences, which have effectively increased the importance of teaching discrete mathematics. It has also been suggested that simultaneously teaching difference equations/recursive methods alongside continuous approaches to population modeling can allow students to encounter the rich interplay between continuous and discrete approaches (Ekici & Plyley, 2018), and may enhance aspects of students mathematical learning (Plyley & Ekici, 2018).

In this paper, we discuss how the first two authors engaged in-service STEM teachers in locally relevant STEM projects while providing year-long support through a directed professional development program. The goal of the program is to make STEM learning experiences more locally-accessible, culturally-relevant, and interesting for students living in underrepresented or isolated communities. Through this process, the authors work to form *professional learning communities* (PLCs) consisting of STEM teachers, university faculty, students, and community partners, which focus on locally relevant and culturally responsive projects. Our research questions are as follows:

1. How do culturally responsive practices provide equitable access to STEM learning for secondary students and STEM community, in and out of the classrooms, through a population dynamics project?
2. How can we provide teacher professional development to interdisciplinary STEM teacher teams in response to their needs in implementing a population dynamics and control project?

Methodology - Collaborative Action Research in STEM PLCs

Structuring STEM Professional Development

Since 2013, with funding from the National Science Foundation (NSF), the University of the Virgin Islands (UVI) has provided year-long training and support for in-service STEM teachers through the *Virgin Islands Institute for STEM Education Research and Practice* (VI-ISERP), an organization chartered in 2014. The first author served as the founding research director of VI-ISERP from 2014-2017, with second author assuming this role thereafter for St. Croix and beyond.

As part of its mission, VI-ISERP has created the following structure for in-service STEM teacher professional development. Interdisciplinary teacher teams are formed and partnered with community experts and university faculty to investigate culturally relevant STEM challenges. The participants take part in year-long PLC activities centered around integrated STEM projects; for instance, lionfish population dynamics, water quality, green home design, and robotics. The PLCs are structured to provide sustained support on the development and implementation of the project, both in and out of school, with critical feedback from other PLCs during joint meetings. Within the context of each project-centered PLCs, there is a reciprocal learning exchange between „mentor teachers" that lead the project and the other members of the wider educational community. The goal of this research program is to provide equitable access to quality STEM instruction for all students using culturally responsive practices and to develop local best practices.

With collaborative action research known to develop the capacity of teachers as scholars of practice (Sagor, 2010), the PLC participants are enrolled in graduate level action research courses at UVI. As part of their process, teachers form research questions, collect and analyze data, and present their findings as the interdisciplinary projects develop their stories. Participants are taught a mixed method approach with supportive quantitative and qualitative data.

Further, VI-ISERP provides a concentrated 10 day professional development session each summer. Following this event, teachers take part in year-long follow-up activities focused on developing advanced disciplinary perspectives, standards-based interdisciplinary connections, mathematical modeling techniques, and pedagogical and technological training relevant to their interdisciplinary projects. To this end, the authors developed *STEM Teacher Circles* (Ekici & Plyley, 2017). The STEM Teacher Circles run two to three times each semester, building on the summer workshop and action research training.

An Exemplar STEM Professional Learning Community - The Lionfish Project

As an exemplar, we will describe both the development (including student-led research questions and conjectures) and the action research steps of the PLC that was formed around the population dynamics and control of the invasive lionfish population near St. Croix. Although the number of persons involved in the project changed over time, two mathematics and two science teachers began leading the project with partial support from approximately 30 other STEM teachers in the wider educational community. The project took place at various times in-class, after school, and on weekends with the participants being especially involved in community outreach activities during these after-school hours.

This lionfish research project has gone through three cycles of iteration of action research since 2015. The initial teacher team (A. Acosta (mathematics), N. Santana (science), and R. Gordon (science)) used their first cycle of action research to launch their project and refined their short-term and long-term project goals, and their interdisciplinary learning outcomes, as they collected and analyzed their data. This process acts to simultaneously improve their practice and activities with students, their outreach activities with community members, and the student and teacher outcomes of the project. During the second cycle of action research, the participating teachers (NSantana, R. Gordon, I. Rosado Jr. (mathematics), A. Isaac (M.Ed. student)) were joined by ten total students who had taken part in the project during the first year; these students volunteered to participate in the summer workshops and they assisted with the development of PBL activities that were implemented by the teachers during the school year. With travel support supplied by VI-ISERP, the teachers have been presenting the results from their action research locally and internationally (i.e. Gordon, Santana, Acosta, & Ekici, 2016).

The student-led orientation of the project became an "*Eat to Beat"* campaign, where students investigated whether they could counter the invasive lionfish population by promoting the lionfish as a food source; an approach which allowed the STEM teachers act as community activists (see Harvey and Mazzotti, 2015). Lionfish are now being harvested recreationally and commercially throughout most of the invaded regions, and are served in over 160 restaurants (NOAA, 2016). The teachers formulated the following learning objectives for the *Eat to Beat* project:

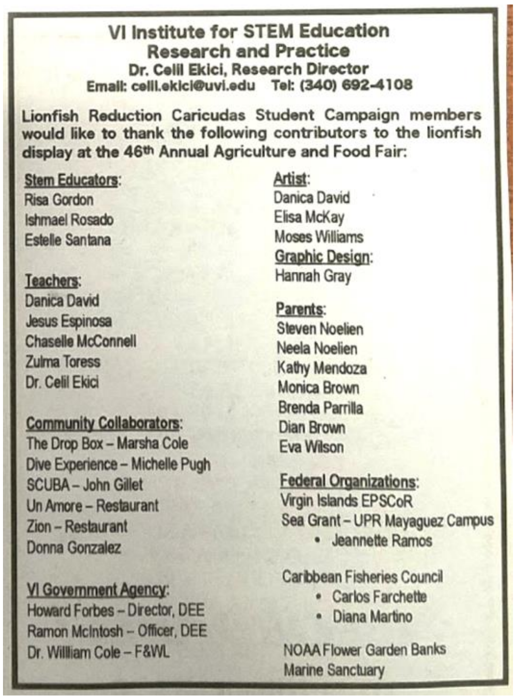
- Introduce lionfish as a food source, have the public consumers view lionfish as a delicacy, and teach the community how to safely handle, clean, prepare, and cook the lionfish.
- Develop, implement, and analyze a rubric to assess the public perspective on lionfish as a food source.
- Educate the public on the dangers and impacts of invasive lionfish to the ecosystem and economy,
- Inform the community about the negative impacts of lionfish on the local food supply.
- Stay up-to-date with science and technology behind effective lionfish capture and counting.
- Organize and support lionfish derbies and create a greater public demand for lionfish.

  Justifications for the *Eat to Beat* project came from teacher directed student research into the phenomena. Samples of student reasoning include:
- In the Bahamas, lionfish are estimated to eat 1000 pounds of native reef fish per acre per year. So if we don"t remove the lionfish, our reef fish may disappear and the health of our reefs will diminish.
- Since the lionfish has no natural predators in the Caribbean, humans should be inserted into the ecosystem to act as the main predator.

To develop the identity and agency of participants, the *Eat to Beat* team designed a logo for their campaign (see Figure 1). They choose the name *Caricudas*, combining the names of their team mascots from two neighboring high schools, St. Croix Educ. Complex (*Barracudas*) and St. Croix Central High(*Caribs*).

Figure 1. Student lionfish campaign logo

They also designed lionfish costumes and masks for some of the community events they participated in. To assess the effectiveness of their campaign, the team designed surveys to assess community awareness of the lionfish problem and their attitudes towards the consumption of lionfish. These surveys were administered during the St. Croix Annual Agricultural Fair, which is an important cultural festival in the Caribbean. In addition, one year the students prepared lionfish food samples and also took part in NSF funded *Science Cafes,* where they presented to the public alongside the project members and Dr. Tyler Smith (National Science Advisory Board Member), discussing the edibility of lionfish, in an effort to combat the ciguatera neurotoxin controversy.



VI Institute for STEM Education Research and Practice
Dr. Celil Ekici, Research Director
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Lionfish Reduction Caricudas Student Campaign members would like to thank the following contributors to the lionfish display at the 46th Annual Agriculture and Food Fair:

Stem Educators:
Risa Gordon
Ishmael Rosado
Estelle Santana

Teachers:
Danica David
Jesus Espinosa
Chaselle McConnell
Zulma Toress
Dr. Celil Ekici

Community Collaborators:
The Drop Box – Marsha Cole
Dive Experience – Michelle Pugh
SCUBA – John Gillet
Un Amore – Restaurant
Zion – Restaurant
Donna Gonzalez

VI Government Agency:
Howard Forbes – Director, DEE
Ramon McIntosh – Officer, DEE
Dr. William Cole – F&WL

Artist:
Danica David
Elisa McKay
Moses Williams

Graphic Design:
Hannah Gray

Parents:
Steven Noelien
Neela Noelien
Kathy Mendoza
Monica Brown
Brenda Parrilla
Dian Brown
Eva Wilson

Federal Organizations:
Virgin Islands EPSCoR
Sea Grant – UPR Mayaguez Campus
• Jeannette Ramos

Caribbean Fisheries Council
• Carlos Farchette
• Diana Martino

NOAA Flower Garden Banks Marine Sanctuary

Figure 3. Lionfish campaign advertised in newspaper, April 16, 2017

During the dish sampling, the safety of lionfish consumption was repeatedly questioned. In fact, even some student participants ultimately conjectured that "*even if you take the spikes out, the level of ciguatera will be too high to be safe….since it is high in food chain*." Student research had students find that (in 2014) ciguatera toxin levels in lionfish collected from waters surrounding the USVI was found in 40% of lionfish, with about 12% having levels that exceed safe consumption levels provided by the U.S. Food and Drug Administration (FDA) (see Robertson et. al, 2014). However, deeper analysis revealed that in fact only one lionfish from St. Croix was actually included in the 2014 sample, and identifying the location of the catch suggested that the degree of accumulation of ciguatoxin may be habitat specific. Participants also discovered that none of the samples from other locations (i.e Trinidad and Tobago) demonstrated levels above FDA regulations. This caused students to revise their earlier conjecture. Considering the controversies and health implications, the project team sought further expert support, and project leaders had two experts provide seminars for participants and the public at community events revealing myths behind potential ciguatera poisoning with lionfish. Indeed, later research suggested that there is no evidence that lionfish in ciguatera-free areas are a threat to public health (Wilcox & Hixon, 2015; Hardison et al., 2018).

Another issue that students had to address during the campaign was: *is it safe to eat as much lionfish as you want?* Students were concerned the amount of mercury that would be consumed from lionfish. The teachers facilitated activities which compared mercury levels in edible fish (lionfish average .07 mg/kg of mercury, compared .91 mg/kg for black grouper, .25 mg/kg for yellowfin tuna, and 1.51 mg/kg for king mackerel). They ultimately determined that mercury was not a concern for lionfish consumption.

Ultimately, the data analysis by the participants determined that many in the population (particularly, the older demographic) were unwilling to incorporate lionfish into their diet. Iterating, the project members re-assessed their strategy and revised their plan for lionfish harvesting. In particular, they included the use of lionfish as agricultural mulch into their model for lionfish control (along with human consumption). Following a visit to a local farming supply store, they re-assessed after learning about the local farming practices involving mulch on the island. More extreme hypothetical avenues, including using the neurotoxin of a lionfish as a bioweapon, were suggested, but ultimately dismissed due to the obvious safety issues in this hands-on learning environment. However, these questions and discussions led to student inquiries into health science related issues, and the teachers followed up with further investigations into neurotoxicity and treatment options for the lionfish venom, which is found in the needle-sharp dorsal, pelvic and anal fins of a lionfish. Biology in-class sessions henceforth have included modules on differentiating venom and poison.

Follow-up Focus Group with Project Leaders - Limitations

Following the project implementation, focus groups and interviews were conducted with the project leaders. It was noted that although the project leaders examined the trends in the local population‟s attitudes toward lionfish, they acknowledged that they "*didn't have quite enough time to analyze the data with their students in the classroom*". Further, some teachers commented that the alignment of the project activities did not fit well with the geometry topics that mathematics teacher was teaching at the time. They reflected on the importance of administrative support so that they could receive course assignments that better allowed them to integrate the aspects of their project; in particular, survey data analysis. They noted that the absence of the statistics teacher that was initially involved in the project impacted the integration of statistics topics.

Responding to Research Questions

The *"Eat to Beat"* PLC was particularly exemplar in its engagement of the community, industry experts, partners, resources. These efforts were mostly coordinated by project leader N. Santana during the 2016-2017 school year (see Figure 3). For example, the project team utilized community partners such as the *Reef Responsible* initiative; a sustainable seafood initiative designed to help create a sustainable seafood industry in the U.S. Virgin Islands. With *Reef Responsible,* the campaign implemented a lionfish festival that had chefs compete for the best lionfish dish. The ample community partnerships helped to ensure the project built locally responsive and community engaging practices. Further, the level of engagement and diversity of participants and activities, both in and out of the classrooms, provided ample evidence of equitable access to interdisciplinary STEM learning with students and the community.

Figure 3. Ms. Santana portraying community partners and a community expert assisting

PAGE 4 The Avis FRIDAY, FEBRUARY 17, 2017

Students study impact of lionfish on ecotourism industry

BRITNEY KNIGHT

ST. CROIX — Students from the St. Croix Central High School and St. Croix Educational Complex have partnered to study the impact lionfish are having on fishing and ecotourism industry in the Virgin Islands.

The students are working through the University of the Virgin Islands science, technology, engineering and math program, according to university statement.

The students hope to promote the consumption of lionfish and plan to do so by introducing it to the palates of residents and visitors alike. Once the public has been provided with information and learn that the lionfish is high in healthy Omega-3 fatty acid, has zero saturated and trans fat and are a great source of protein and is not poisonous, they will be willing to buy and consume the species, the release stated.

Studies by scientists have concluded that lionfish pose no greater threat of ciguatera than the popular species of fish consumed by locals and visitors to our island.

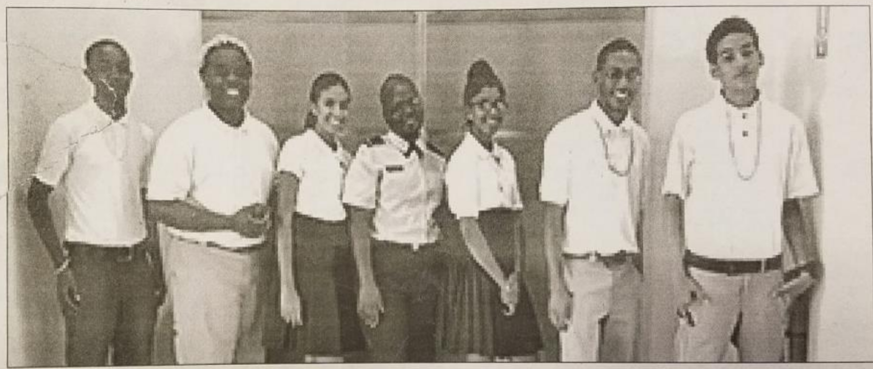
According to the statement, understanding the magnitude of the impact that an uncontrolled population growth of lionfish will have on commercially viable juvenile fish in the coral reefs, the students have begun a campaign to educate and raise awareness in the community that the lionfish is edible once the spines have been properly removed. They intend to introduce the lionfish as a delicacy so it can become a popular food choice on the table of the Virgin Islanders, the release stated.

Demand for lionfish by consumers will reduce the numbers of lionfish in the marine environment and a balanced population of lionfish will help protect commercially viable juvenile fish, the release stated.

To launch the campaign the students will participate in this weekend's Agriculture and Food Fair where they will provide information on lionfish, according to Nora Santana, one of three STEM educators assisting students.

The public is invited to visit the lionfish display from 11 a.m. to 3 p.m. on Saturday, from noon to 3 p.m. on Sunday and from noon to 4 p.m. on Monday.

Visitors can expect to receive information pamphlets, listen to lectures, and view videos, and demonstrations. There will also be varied dishes of lionfish to sample, Santana said.



Submitted photo

Students from St. Croix Central High School and St. Croix Educational Complex have partnered with UVI to study the impact lionfish are having on fishing and ecotourism industry in the Virgin Islands. The public is invited to visit the lionfish display from 11 a.m. to 3 p.m. on Saturday, from noon to 3 p.m. on Sunday and from noon to 4 p.m. on Monday. There will be information as well as varied dishes of lionfish to sample.

Figure 4. Eat to Beat students in the local newspaper

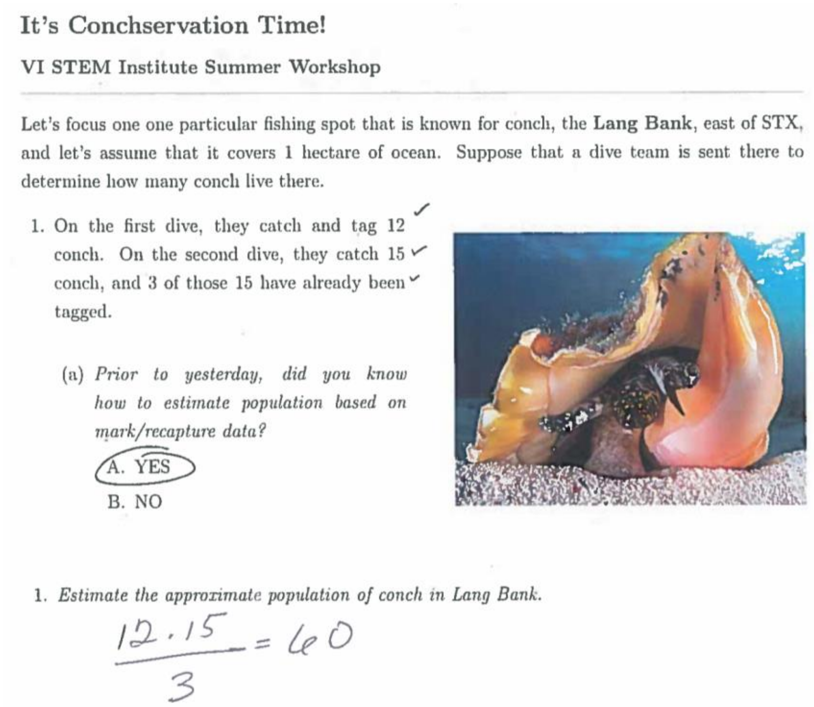
Responding to the second research question, professional development was provided based on teachers" emerging needs in implementing culturally responsive integrated STEM PBL units. For the lionfish project, STEM Teacher Circles were designed specifically in response to teachers needs in implementing the project with their students; specifically, the first two authors provided training in the mathematical and scientific modeling of population dynamics for a group of about 35 STEM teachers in the summer of 2016 and twice in the fall of 2016. This training was purposefully designed to make mathematical content of modeling more accessible for secondary STEM learners, and especially when incorporating advanced ideas like irregular harvesting. We also provided statistical modeling approaches for parameter estimations to study growth rates. In addition to mathematical modeling perspectives, we invited lionfish experts to share their research perspectives on lionfish, such as the toxicity level. To support meaningful integration of technology, we offered training and connections to relevant technologies, such as spreadsheet modelling in *Microsoft Excel* and dynamical system modeling with *Insightmaker,* which is a free open-source general-purpose tool and platform for web-based modeling & simulation and sharing (Fortmann-Roe, 2014). It is available from InsightMaker.com.

Assessment of Culturally Responsive STEM PBL Student Learning

Integrated STEM lessons present concepts that are not always unidimensional for their measurement and assessment. Student ability in a core subject at a grade level is usually conceptualized as a unidimensional trait for assessment purposes. Math ability, for example, is conceptualized as a unidimensional trait which allows us to assign numbers to students on a continuum to represent the students" ability. For integrated STEM learning, assigning numbers to student ability on one dimension is not an option unless STEM ability is conceptualized as a two-level model. STEM ability could be modeled with a higher order complex ability, with lower level abilities representing those that are unidimensional, such as math ability, problem solving, or making connections. Multidimensionality of integrated STEM learning aligns with the assumption that students are provided lessons that will require them to use their knowledge in science, technology, math, and engineering while being able to make connections amongst them. Integrated STEM learning materials do not necessarily always tap into all core areas of STEM. Sometimes only a subset of the four core areas is integrated in a STEM learning unit. In addition to the core area abilities, other traits such as problem solving, communication and collaboration, making connections, and interpreting results become major learning outcomes from PBL units.

Within the purpose of highlighting the possible learning outcomes that could be fostered with integrated STEM learning PBL units and the purpose of exemplifying the ways to measure those outcomes, we provided teacher training on the assessment of mathematical modeling and integrated project based STEM learning outcomes incorporating culturally responsive practices. Performance assessment is investigated as it provides a better platform to measure project based learning outcomes in various dimensions including problem solving, communication and collaboration, making connections, and interpreting results. Formative assessment is partnered with performance assessment for the training. Within the formative assessment, learning and assessment goes hand in hand, where teacher guides, observes, measures, and provides feedback during the learning process.

We adopted a performance assessment rubric as developed by the New York Performance Standards Consortium (2016). Teachers are asked first to work in pairs on culturally relevant STEM tasks, such as lionfish and queen conch population modeling (see Figure 5).



It's Conchservation Time!

VI STEM Institute Summer Workshop

Let's focus one one particular fishing spot that is known for conch, the **Lang Bank**, east of STX, and let's assume that it covers 1 hectare of ocean. Suppose that a dive team is sent there to determine how many conch live there.

1. On the first dive, they catch and tag 12 conch. On the second dive, they catch 15 conch, and 3 of those 15 have already been tagged.

   (a) *Prior to yesterday, did you know how to estimate population based on mark/recapture data?*

   A. YES

   B. NO

1. *Estimate the approximate population of conch in Lang Bank.*

$\frac{12 \cdot 15}{3} = 60$

Figure 3. Conch activity sample

Each pair received another pair‟s solution to evaluate, while applying the rubric. After using the rubric, teachers are asked to discuss the rubrics and how they work for integrated STEM learning assessment. Some participants supported the rubric, believing it to be a good tool to establish a standard way to measure student performance, whereas others criticized it. Several teachers indicated that a rubric aligning with the performance attributes simplifies the measurement process. Some of the criticism focused around the clarity of the language and descriptions of one or more performance indicators and the difficulty of classifying the observed performance with the given performance categories. One teacher indicated that it was hard to evaluate the task with no answer key available, which is common in project-based learning. One science teacher indicated that the assessment process was hard for science teachers due to the inherent math content. When integrated STEM learning material is presented, students might be required to use their knowledge in any, all, or several, areas of STEM and the assessment becomes harder for teachers who are not comfortable in one or more of these areas.

Reliability is one of the most essential features of a good measurement. For a performance assessment with the use of a rubric, inter-rater reliability is expected to be established. Research from the teacher training on the assessment of mathematical modeling and integrated STEM learning outcomes with PBL units incorporating culturally responsive practices (Alagoz & Ekici, 2018) found that the teachers were pretty consistent in using the rubric for problem solving, and reasoning and proof, yet their grading was not as accurate for the communication trait. It is recommended to further calibrate the grading process. Alagoz and Ekici (2018) presented a multidimensional measurement of mathematical modelling which offers individualized feedback for instructional support to mathematics teachers with evidence based on student performance. This multidimensional measurement approach identified distinct attribute mastery profiles among learners and provided fine grained individualized feedback.

Validity is another essential feature of a good measurement. Even though validation is an iterative process, there are steps to be taken at the beginning of the assessment to make sure the assessment process is appropriate for measuring the outcomes we would like to measure. Large scale assessments go through standard setting procedures to establish cutoff scores on continuous proficiency scales which are used later to assign students into categories. When we use previously created rubrics that presents performance indicators to place students into categories, the standard setting process is inherently present in the rubric. The rubric becomes the standard. It is essential to make sure the rubric has the potential to set the standard which consequently contributes to the validity of the assessment. In a validity study of mathematical modelling, Ekici and Alagoz (2018) provided an approach to facilitate a standard setting like process to a formative performance assessment for mathematical modeling, coordinating disciplinary and interdisciplinary connections. Expert teacher practices guided to establish meaningful and valid measurements for untraditional competencies with interdependencies as in the case of integrated STEM learning tasks.

Building Evidence on Locally Effective Culturally Responsive STEM Practices

Building on Ladson-Billings's seminal work (Ladson-Billings, 1995), we studied eight indicators of culturally responsive practices by STEM teachers (Greenstein & Ekici, 2017). We added more community engaging practices with exemplars:

- Communication of High Expectations
- Active Learning Methods
- Teacher as Facilitator
- Inclusion of Culturally and Linguistically Diverse Students
- Cultural Sensitivity
- Reshaping the Curriculum (not top down)
- Student Controlled
- Classroom Discourse
- Small Group Instruction and Academically Related Discourse

One of the emerging need for teachers has been on the assessment of mathematical modeling practices and learning outcomes with the integrated STEM learning projects. Supplemental trainings were developed and provided by Alagoz and Ekici between Spring 2016, and Summer 2017 in the educational measurement and validity of modeling assessments (Alagoz & Ekici, 2018). Building on the culturally responsive indicators of practice (Greenstein and Ekici, 2017), we aimed to assess the degree to which:

- The units are relevant to students community and culture
- Students see themselves represented in curricular materials
- Materials are accessible
- Materials promote active, inquiry-based learning
- STEM and other disciplines are integrated
- STEM curriculum is connected to local concerns and social justice issues

Partial results in relation to mathematics teachers" practices can be found in (Greenstein & Ekici, 2017). The impact of culturally responsive pedagogies for STEM teachers are currently being investigated upon revision of the instruments.

Recommendations

Building professional learning communities around locally relevant and culturally responsive relevant STEM problems can be time consuming. Having specialized roles, for example, having one of the team members focus on community engagement and outreach experience, was beneficial in this case. This STEM learning project was a highly rewarding inclusive experience for students, teachers, and the community participants. The lionfish project was ambitious, as it was driven and initiated by the teachers and their students. A powerful aspect of the project was that students and teachers assumed the role of community activists. The level of student engagement necessitated time that was beyond regular class time, but the level of student interest and engagement meant that students were willing to do this, even during the weekends. Students-agency and identity as scientists and STEM education researchers were fostered while they worked in their communities interacting with multiple stakeholders and scientists. While the ultimate objective of controlling the lionfish population by human consumption was ultimately beyond the scope of this project, the process allowed students and each member of learning-community to observe the potential impact and take part in an extremely authentic and relevant STEM challenge. Later on, as the project progressed, the team observed that similar campaigns were conducted especially in Florida (Harvey and Mazzotti, 2016). As an ongoing project, team members have decided to revisit to delineate the scope and sequence of activities, to provide more sustainable practice for other teachers and students to emulate.

Acknowledgements

This work is partly supported by the National Science Foundation (NSF) under Grant Number 1355437. Any opinions, findings, and conclusions or recommendations expressed here are those of the authors and do not necessarily reflect the views of NSF. During the implementation of the lionfish project, Ms. Nora Santana as a science teacher has been greatly instrumental leading the “Eat to Beat”-Lionfish project orchestrating activities in and out of classroom with community partners. Mr. Rosado Jr. as a mathematics teacher from Virgin Islands Department of Education provided support as mathematics teacher and incorporating relevant technologies related to surveys and their analysis.

References

Alagoz, C., & Ekici, C. (2018, Under Revision). Cognitive Diagnosis Models for Mathematical Modeling Assessment. In G. A. Stillman, J. Brown et al (Eds). *Book Series on Teaching and Applying Mathematical Modelling*. Chichester: Horwood Publishing.

Au, K. H., & Kawakami, A. J. (1994). Cultural congruence in instruction. In E. R. Hollins, J. E. King, & W. C. Hayman (Eds.), *Teaching diverse populations: Formulating a knowledge base* (pp. 5-23). Albany: State University of New York Press.

Brown, M. R. (2007). Educating all students: Creating culturally responsive teachers, classrooms, and schools. *Intervention in school and clinic 43*(1), 57-62.

Common Core State Standards for mathematics (CCSSM). (2010). Washington, DC: National Governors Association and The Council of Chief State School Officers. Retrieved from http://www.corestandards.org/Math/

Ekici, C.& Alagoz, C., (February, 2018). *Teachers validity arguments for mathematical modeling: Competency measures and connections.* 22nd Annual Conference of the Association of Mathematics Teacher Educators, Houston, Texas.

Ekici, C., & Plyley, C. (2018). Inquiry based modeling of population dynamics with logistic differential and difference equations. *PRIMUS: Problems, Resources, and Issues in Mathematics Undergraduate Studies*. https://doi.org/10.1080/10511970.2018.1484399

Ekici, C., & Plyley, C. (2017). *Math Circles for Integrated STEM Learning Communities.* Presentation at Joint Mathematics Meetings Jan 7, 2017, Atlanta, Georgia.

Fortmann-Roe, S. (2014). Insight Maker: A general-purpose tool for web-based modeling & simulation. *Simulation Modelling Practice and Theory, 47*, 28-45

Fortus, D., Krajcik, J., Dershimer, R. C., Marx, R. W., & Mamlok-Naaman, R. (2005). Design-based science and real-world problem-solving. *International Journal of Science Education, 7*(3), 855-879.

Freire, P. (2000). *Pedagogy of the oppressed.* New York, NY: Continuum.

Gay, G. (2000). *Culturally responsive teaching: Theory, research, and practice.* New York: Teachers College Press.

Gordon, R., Santana, N., Acosta, A. A., & Ekici, C. (2016, October). *Critical Study & Community Based Approaches to Lionfish Problem for a Culturally Responsive STEM Education in the Caribbean.* Paper presented at International STEM Education Association Meeting Branson MO.

Greenstein, S., & Ekici, C. (2017). At the Intersection of Teaching and Cultural Diversity: Modeling a Culturally Responsive Mathematics Pedagogy for the U.S. Virgin Islands. *Journal of Mathematics and Culture, 11* (4), 39-82.

Hardison, D.R., Holland, W.C., Darius, H.T., Chinain, M., Tester, P.A., Shea D, et al. (2018) Investigation of ciguatoxins in invasive lionfish from the greater caribbean region: Implications for fishery development. *PLoS ONE 13*(6): e0198358. https://doi.org/10.1371/journal.pone.0198358

Harvey, R.G. and F.J. Mazzotti. (2015). *Public Awareness and Attitudes toward Invasive Lionfish*. Interim Report to the Florida Fish and Wildlife Conservation Commission.

Hollins, E. R. (1996). *Culture in school learning: Revealing the deep meaning.* Mahwah, NJ: Lawrence Erlbaum.

Kleinfeld, J. (1975). Effective teachers of Eskimo and Indian students. *School Review, 83*(2), 301-344.

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal, 32*(3), 465-491.

Mathematical Association of America (MAA) (2015) *CUPM Curriculum Guide to Majors in the Mathematical Sciences.* Retrieved from http://www.maa.org/sites/default/files/pdf/CUPM/pdf/CUPMguide print.pdf

National Oceanic and Atmospheric Administration(NOAA) /NCCOS.(2016) Lionfish 2016 February.. Available from: https://coastalscience.noaa.gov/research/pollution/invasive/lionfish.

National Research Council (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. Washington, D.C.: The National Academies Press.

New York Performance Standards Consortium. (n.d.). Math rubric for performance based assessment tasks. Available at http://performanceassessment.org/performance/prubrics.html.

Next Generation Science Standards Lead States. (2013). *Next generation science standards: for states, by states*. Washington, D.C.: The National Academies Press.

Plyley, C. and Ekici, C. (To Appear). *Developing Strategic Competence with Representations for Growth Modeling in Calculus*. In Proceedings for the Conference on Research in Undergraduate Mathematics Education, Feb 22-24, 2018. San Diego,

Robertson A, Garcia A.C., Quintana, H. A. F., Smith, T.B., Castillo, B. F., Reale-Munroe, K., et al. Invasive lionfish (Pterois volitans): a potential human health threat for ciguatera fish poisoning in tropical waters. *Mar Drugs. 2014, 12*(1):88–97. pmid:24378919

Sagor, R. (2010*). Collaborative action research for professional learning communities.* Bloomington, IN: Solution Tree Press.

Satchwell, R. E. and Loepp, F. L. (2002). Designing and implementing an integrated mathematics, science, and technology curriculum for the middle school. *Journal of Technology Education, 39*(3), 41-66.

Wilcox CL, Hixon MA. (2015). False positive tests for ciguatera may derail efforts to control invasive lionfish. *Environ Biol Fish. 98*(3):961–969.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 11-22

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

The Perceptions of Pre-Service and In-Service Teachers Regarding a Project-Based STEM Approach to Teaching Science

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Abstract: Whilst much attention has focused on project-based approaches to teaching Science, Technology, Engineering and Mathematics (STEM) subjects, little has been reported on the views of South-East Asian science teachers on project-based STEM approaches. Such knowledge could provide relevant information for education training institutions on how to influence innovative teaching of STEM subjects in schools. This article reports on a study that investigated the perceptions of 25 pre-service and 21 in-service Malaysian science teachers in adopting an interdisciplinary project-based STEM approach to teaching science. The teachers undertook an eight hour workshop which exposed them to different science-based STEM projects suitable for presenting science content in the Malaysian high school science syllabus. Data on teachers‟ perceptions were captured through interviews, open-ended questions and classroom discussion before and at the end of the workshop. Study findings showed that STEM professional development workshops can provide insights into the support required for teachers to adopt innovative, effective, project-based STEM approaches to teaching science in their schools.

Keywords: Professional development, Project-based learning, Science, Teaching innovation, STEM

Introduction

The Malaysian educational system is currently undergoing transformation, one emphasis of which is to create a generation who can think creatively, innovatively and critically (Ministry of Education 2012a). As part of the reform efforts, the Malaysian Ministry of Education (MOE) has created initiatives that aim to increase teachers‟ and students‟ competencies in Science, Technology, Engineering and Mathematics (STEM) subjects and create learning experiences that will prepare students for the considerable array of STEM career fields.

In spite of the emphasis on STEM, science and mathematics are not subjects of first choice for a majority of Malaysian high school students, whose interest in science subjects has been steadily falling (Phang et al. 2012). During the mid-1980s, the ratio of students taking science to arts subjects was 31:69. By 2012, this had fallen to 27:78 (Ministry of Education 2012b). The number of science stream students has dropped up to 29% since 2007 (Ayob 2012). One reported reason for falling enrolment in many science programs is that students are turned off by the way these subjects are taught, as Phang et al. (2012) reported that students find studying science to be difficult, boring and not worth the effort. These findings reflect broader concerns that declining interest of students in science and mathematics may stunt the efforts to improve technological innovations to make Malaysia a high income country by 2020.

Equally alarming, recent international comparisons of 15-year-old students‟ performance in the 2012 Program for International Student Assessment (PISA) examination, indicate that Malaysian students scored below the international average, ranking 52 out of the 65 countries in mathematics, science and reading (OECD 2014). Further analysis shows that Malaysian students ranked 39 out of the 44 countries with a mean score of 422 on creative problem-solving, designed to assess students‟ abilities to apply scientific and mathematical concepts to real-world problems (OECD 2014). The mean score for all countries was 500. Malaysia had more than half the share of low achievers, revealing students‟ lack of the kind of skills needed to tackle real life problems that are increasingly needed in today‟s workplace.

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

Malaysia plans to develop creative and innovative human capital to meet the nation‟s need in the 21st century. However, if current trends persist, the Science and Technology Human Capital Direction Plan 2020‟s requirement of 60% STEM workforce may not be achieved. These trends raise the question „What can science educators do to enhance and promote interest in science and other disciplines in STEM?‟
It follows that in order to attract more students into STEM careers, students should be provided with meaningful learning experiences that motivate and excite them, and that relate to their own context. To this end, science educators should be capable of offering learning experiences that engage students in realistic, thought-provoking problems, working with others, and applying their knowledge, skills and creativity in finding solutions to real-world problems. However, teachers may face significant challenges fostering an interest in STEM subjects. One of the biggest challenges for Malaysian primary and secondary science education is that few guidelines or models exist regarding how to teach using STEM approaches in the classroom. In view of these points, this study generated and examined a range of ideas on how to enhance awareness among teachers on science teaching through STEM approaches, and how these could motivate and excite students, as well as themselves, in teaching and learning science in schools.

Literature Review

STEM-project-based learning (STEM-PjBL) as pedagogy in the teaching and learning of science

Many scholars argue that for students to be fully prepared for careers in STEM, they should engage in pedagogical practices that reflect the interdisciplinary, ill-defined problems that scientists face (Anderson 2007; Clark and Ernst 2007; Marshall et al. 2007; Paige et al. 2008; Park-Rogers et al. 2007). In response, many countries have developed reforms and initiatives to shape teaching and learning across STEM disciplines. A number of these are interdisciplinary and integrative in nature, with blurred boundaries among the four disciplines (Wang et al. 2011). Linking STEM subjects offers considerable advantages, notably getting students to make sense of learning content across the four subjects, while promoting critical thinking and problem-solving skills (Beane 1997; Drake 1991; Drake 1998; Jacobs 1989; Miller 1995; Nielsen 1989).

To mirror scientists‟ problem-based work, a carefully crafted interdisciplinary approach to STEM teaching allows students to experience ill-defined problems, and provide them with avenues to solve these through a variety of answers, as opposed to single answer solutions more typical of didactic teaching approaches. Very little research has explicitly examined project-based learning (PjBL) as a pedagogical framework for teaching interdisciplinary STEM subjects. Actually, many of the learning experiences advocated in STEM teaching approaches are similar to the underlying principles of PjBL. Hence, PjBL in STEM (or STEM-PjBL approach) has promise as a framework for STEM initiatives.

In a STEM-PjBL learning environment, important concepts in STEM subjects can be gained in solving complex problems (Hickey 2014). Teachers in this environment could guide students in small groups to develop a variety of solutions for a given problem, encouraging collaborative learning and strengthening critical thinking and communication skills (Hickey 2014). Moreover, as students engage with the STEM-PjBL approach, they are in essence mirroring the processes used by scientists and engineers to solve real-world issues through the active construction of new knowledge and the development of problem-solving skills (Flores et al. 2002; Gutstein 2003; Rogers and Portsmore 2004).

Design-Based Science (DBS) is one example of a STEM-PjBL approach. In DBS, students actively engage with problem solving through designing and building artefacts (Fortus et al. 2005). The DBS process provides students with opportunities to carry out series of experiments, with hands-on activities that relate to STEM subjects content (Satchwell and Loepp 2002). Research has also shown that project-based learning that integrates concepts in STEM subjects has enabled students to transfer their knowledge and skills to solve real-world problems (Fortus et al. 2005), which has in many occasions led to improved scores in higher-level mathematical problem solving and scientific process skills (Satchwell and Loepp 2002).

Motivating students through a STEM-PjBL approach

Educators have shown that the use of a STEM-PjBL approach has been useful in getting students to make sense of learning science content that is within the science syllabus students study in school. This approach has particularly worked well for the academically less-inclined students. Amir (2014) argues that while the prescribed science experiments in the secondary school activity books for these students allow teachers to engage them in learning through a hands-on approach, a large number of these experiments provide little room to foster and reward these students for being able to showcase their creativity through knowledge from science. Students, in doing these experiments, are seen to be going through a routine of steps as instructed by their teachers with hardly much opportunity for them to put their imaginative and inventive skills to good use (Abrahams and Millar 2008; and Abrahams and Millar 2008). Amir and Subramaniam (2014) mentioned that these students have been observed to ask questions about the relevance of learning some of the skills and concepts taught in the experiment books. Amir and Subramaniam (2014) cited an example of their observation of students asking questions on how learning the skills in using the vernier caliper to measure the internal and external diameter of a test tube and compact disc (as described in their activity books) would be useful for them in their daily lives. The use of a STEM-PjBL could address some of these concerns in motivating students to learn science (Elkind 1999). However, the choice of the project to be presented to students does matter. Ideas from educators have shown that the use of projects that kindles interest in students does make a difference in motivating them to be interested in doing the projects (Amir 2014; Kangas 2010; Lan 2011; Meyer 2012; Resnick et al. 2000).

A way for science teachers to get students excited in learning science through projects is to infuse play into lessons. „Play‟ is a critical issue to consider when introducing science concepts as a means to make learning science fun (Stables 1997). Play also promotes innovation and stretches students‟ imagination to foster creativity (Parker-Rees 1997). Play factors can be infused into lessons that present both elementary and complex science concepts. An example of a complex physics concept that has the play factor embedded is shown by Sabin et al. (2008). In the example, the authors described how they made use of a context of superheroes belonging to different groups to present complex concepts in quantum physics. Merging elements of „play‟ to physics, as shown through such a move, managed to generate interest in students to solve problems in physics. Another way to infuse elements of „play‟ is through the use of toys. Using toys excites students and builds up their enthusiasm to learn science concepts (Güémez et al. 2009; Featonby 2005; Phillips et al. 2002; McGartland 1998; and Parker-Rees 1997). Toys are also not limited by a certain language and are thus suitable for use across all ages and cultures (Yau and Wong 2004). Books have been published to show how teachers can inject fun into their lessons by teaching science through the use of toys (McCullough and McCullough 2000; Sills 1999; Sarquis et al. 1995; Sarquis et al. 1997; Sumners, 1997; Taylor et al. 1995). Examples of how elements of „play‟, such as the use of toys, have been incorporated in the crafting of teaching strategies through STEM-PjBL projects have been described in the literature. These toys can be made from low-cost everyday objects and materials (McGervey 1995). For example, Amir and Subramaniam (2009) described how students get excited about learning physics when they were guided to design and make a low cost candy floss kit gadget through the use of Aluminium foil and objects which are commonly available in the kitchen and a typical physics laboratory. Featonby (2010) and Thompson & Mathieson (2001) showed how „playful‟ hands-on activities can generate students‟ understanding in concepts related to optics through making a „magic mirror coin box‟ toy that can be easily made using simple paper box and a plastic mirror. Oliver and Ng (1999) described how students were made to understand the concept of forces and elasticity by designing and making rubber-band driven toy aeroplanes. Subramaniam and Ning (2004) described how students were made to understand the concept of resonance by making a simple toy that is made with a wooden rod, strings and pendulum bobs. Zubrowski (2002) carried out a study with students using simple materials to make model windmills in getting them understand several science concepts related to forces and motion. Amir and Subramaniam (2006; 2007; 2014) have also described that students were able to not only able to acquire physics content through designing and making toy projects but also in being able to express their creativity through science knowledge in coming up with their own versions of toy designs.

Theoretical Framework and Purpose of Study

Since 2004, Malaysian universities have started research on project-based teaching and learning approaches in the engineering fields (Khair et al. 2011). However, STEM-PjBL approaches have yet to be developed for schools, indicating research needs about teachers‟ understanding and implementation of STEM-PjBL approaches in science teaching. The literature suggests that a STEM-PjBL approach through designing and making science-based toys can be a useful pedagogy to teach science and create students‟ excitement and motivation toward learning science. The researchers believe that when teachers are enabled to engage with such an approach, they would develop STEM-PjBL teaching and learning activities that could set a positive STEM culture in schools. On a bigger scale, implementing a STEM-PjBL approach in science teaching could be a catalyst towards achieving the Malaysian transformation agenda in sparking student interest in STEM subjects.

A professional development workshop approach for pre-service and in-service teachers is one way of creating teachers‟ awareness of science teaching through a STEM-PjBL approach (Laboy-Rush 2007). Knowledge of these teachers‟ views on STEM-PjBL approaches could inform innovative ways of teaching STEM subjects.
The purpose of this study therefore was to investigate the perceptions of Malaysian science teachers in adopting a STEM-PjBL approach in teaching science. A professional development workshop would provide the platform to engage science teachers in STEM-PjBL approaches to science teaching through designing and making science-based toys.
In formulating research questions, the researchers focused on:

- Examining teachers‟ initial perceptions of a STEM-PjBL approach in teaching science,
- Exploring their responses to the professional development experience in using the STEM-PjBL approach (namely the benefits and challenges they faced in the workshop), and
- Exploring the factors that would motivate them to implement the STEM-PjBL approach in the teaching of science in their schools.

The research questions guiding this study are:

1. How would teachers‟ perceptions of PjBL in STEM approach evolve as a result of their participation in this STEM-PjBL workshop?
2. What benefits are gained by teachers through engaging with the workshop?
3. What challenges do teachers face as they engage with the workshop?
4. What challenges would teachers potentially face in implementing a STEM-PjBL approach in their classrooms? What suggestions would they offer to overcome these challenges?
5. What would motivate teachers in applying a STEM-PjBL approach in teaching science in their own classes?

Methodology

Research design

A two-day professional development workshop was carried out to expose teachers to a STEM-PjBL approach in teaching science. Qualitative methods were used to address research questions and how teachers could put into practice what they learned in the workshop.

Time frame and sample

Two weekend days were allocated for workshop. The eight-hour workshop design was the same each day. On the Saturday, 25 pre-service science teachers were involved. The five male and 20 female pre-service science teachers were aged between 20 and 23, were training in Physics and Mathematics and had no teaching experience in schools. In contrast, the 21 in-service science teachers involved on day two were six males and 15 females from the Teacher Graduate Program (PPG) across Sabah. They were aged between 32 and 40 years and had between 8 and 14 years teaching experience in primary schools. Eighty-one per cent of in-service science teachers had no former experience with PjBL, whereas 19% sometimes incorporated project-based teaching approaches in their science lessons.

Collaboration with the workshop facilitator

The facilitator was a Senior Teacher from Singapore with a doctorate in science education, who has adopted a STEM-PjBL teaching approach with his science and Design & Technology (D&T) students for over nine years. Collaboration between the university and the facilitator started six months prior to the workshop. The agreed main approach was to take participants through the classroom teaching practices he adopts which mainly involves students learning science through designing and making toys. The necessary workshop materials were then made ready.

Data Collection

Research instruments included interviews (qualitative data). This approach aimed to provide a holistic view on tracking participants‟ perceptions of and reaction to the STEM-PjBL approach. An open-ended question “What is your overall impression of the workshop?” was stated in view of obtaining written feedback on the participants through the workshop. The instruments were reviewed by a Science lecturer and Science teacher. Since English was not the common language used by the participants, the researchers translated the instruments into Malay; these were reviewed by a Malay language teacher.

Qualitative data were gathered through (a) individual interviews (20–30 minutes), (b) workshop feedback (open questions), and (c) open discussions at the end of the workshop (60 minutes). The qualitative tools sought participants‟ ideas about the benefits and potential challenges they might face carrying out a STEM-PjBL approach and the likely recommendation of STEM-PjBL approach to other teachers in secondary and primary school classrooms. Structured interview protocols were employed with further probing questions following each interview question. Interviews were audio taped and transcribed.

Table 1 shows the tools that are being used to address the corresponding research questions. A group of 15 undergraduate science students were asked to comment on the readability of the items in the data capturing tools. The students agreed that all items were relevant and they should remain in the study.

Table 1. Tools being used to address the research questions

Research Question	Data Capturing Tools
1	i. Interview question administered at the end of the workshop: „Reflecting on your own experience as a learner and as a teacher, what is your overall reaction to the approach shared in this workshop as compared to existing instructional methods?‟ iii. Open question: „What is your overall impression of the workshop?‟
2	i. Interview question administered at the end of the workshop: „What particular benefits do you get while engaging in this workshop?‟ ii. Open question: „What is your overall impression of the workshop?‟
3	i. Interview question administered at the end of the workshop, and ii. Open discussion in class „What particular challenges do you face while engaging in this workshop?‟
4	i. Interview question administered at the end of the workshop, and ii. Open discussion in class „In your opinion, what kind of challenges will you potentially face in implementing a STEM-PjBL approach in classroom? Please give your suggestion in order to overcome these challenges‟.
5	i. Interview question administered at the end of the workshop „Would you like to recommend other teachers to apply a STEM-PjBL approach in teaching science in their own classes? Please give your reasons why you like to do so‟.

Method of Analysis

For written and verbal qualitative data, the researchers used interpretive methods (Erickson 1986) to explore common themes that emerged out of 46 participants‟ statements and words. An iterative process of coding, memo writing, focused coding, and integrative memo writing (Emerson et al. 1995) was followed.

Findings

The qualitative results from participants‟ responses are summarized in Table 4.

Table 4. Summary of participants‟ qualitative responses

Research Question	Participants‟ response	Frequency (N=46)	Percentage
1	*What were participants' reflection on STEM-PjBL approach?*		
	A fun, interesting, enjoyable and exciting approach	28	61.9
	Attract students‟ interest and attention	23	50.0
	Offers opportunities to be creative	15	33.6
	Positive applicability and suitability of STEM-PjBL in learning Science	12	26.1
	Increased motivation to learn	8	17.4
	Supports learning about environmental values	7	15.2
	Developing problem solving skills	3	6.5
2	*What benefits were gained by teachers through engaging with the workshop?*		
	Acquired new experience for making Science classrooms more effective	19	41.3
	Recognizing the interdisciplinary nature of STEM-PjBL approach	15	32.6
	Opening up one‟s mind to designing and making science-based toys	10	21.7
	Fostering creativity and thinking skills	6	13.0
	Inspired to teach in an innovative way	5	10.9
3	*What challenges did teachers face as they engage with the workshop?*		
	Insufficient time to complete tasks	20	43.5
	Lack of subject matter knowledge in a STEM-related field	12	26.1
	Unexpected conditions that contributed to unsuccessful outcomes	10	21.7
	Language as a communication barrier	7	15.2
4	*What challenges [C] would teachers potentially face in implementing a STEM-PjBL approach in their classrooms? What suggestions [S] would they offer to overcome these challenges?*		
	[C] Inadequate materials and facilities		
	Difficulty in obtaining experimental materials	44	95.7
	Rural school laboratories lack equipment provision	23	50.0
	[S] Using readily available recycled or easier accessed materials	44	95.7
	[C] A large amount of experimental materials to cope with large class	17	36.9
	[S] Conducting activities in smaller groups	17	36.9
	Students and school stakeholders take their own initiatives to obtain relevant materials.	42	91.3
	[C] Classroom time constraints	40	86.9
	[S] Carrying out STEM-PjBL lessons after school hours	40	86.9
	[C] Lack of expertise/knowledge in STEM-PjBL related projects	30	65.2
	[S] Exposing teachers to STEM-PjBL training	30	65.2
	[C] Teaching preparation for less interested students	8	17.4
	[S] Planning in advance the activities, materials and apparatus	8	17.4
	[C] Cost constraints	43	93.4
	[S] Doing group activities	23	50.0
	Getting financial support from Ministry of Education	20	43.4
5	*What would motivate teachers in applying a STEM-PjBL approach in teaching science in their own classes?*		
	Able to enhance the understanding of science content	20	43.5
	Learning by doing	14	30.4
	Exposure to real life problems	10	21.7
	Able to foster learners‟ multiple intelligences	10	21.7

Discussion and Conclusion

Findings from this study reveal that the professional development workshop has helped science teachers to expand their insights and build positive perceptions on the use of a STEM-PjBL approach to teach science. The teachers found that the workshop has exposed them to new teaching strategies that offer enjoyable hands-on lessons, such as getting students to design and make science-based toys, in the teaching and learning of science. The teachers believe that this approach could lead to students learning science in ways that excite them, which in turn could promote their interest, motivation and attention in learning science.

In recording the learning of science content through a STEM-PjBL approach, teachers are in favour of the idea of getting students to sketch their toy designs and provide annotations and comments alongside their sketches in describing how knowledge and skills from science contribute to their toy designs. Teachers believed that this approach would not only allow students to gain science content but also in providing an avenue for them to express their creative ideas. Furthermore, teachers felt that this approach caters to the various multiple intelligences in students‟ learning as described by Howard Gardner (1983), namely in tapping on the students‟ visual-spatial, logical-mathematics, and bodily-kinaesthetic and not just visual-linguistics modes. This could help students who may not usually motivated to learn science through the books to be more interested in learning science. Moreover, as teachers go through the STEM-PjBL approach in the workshop, they felt motivated to learn science themselves, which led to a considerable number of them indicating that they will recommend this approach to other science teachers.

There is no clear evidence in this study to measure how a teacher may improve his or her own creative teaching practices. Nevertheless, 46% of the teachers indicated that the creative learning environment setting in a STEM-PjBL approach could provide a way for science teachers to sharpen their critical and creative thinking skills. Several teachers described that the approach has inspired them to teach in an innovative way despite the limited resources. In other words, they believe that the approach will not only promote students‟ creativity but will also give teachers a chance to come up with creative lesson plans, such as using a toy car to teach concepts in mechanics and energy conversion, and using a Cartesian diver toy in teaching the concept of density.

The teachers were also made aware that environment values could also be developed through STEM projects. For example, in the toy solar car project, teachers themselves looked for recycled materials to make the chassis of their toy cars. Positive comments from teachers are suggestive of how their students can be taught to value the environment and promote recycling. Another aspect of the findings is that teachers value the interdisciplinary nature within STEM projects. Such responses highlight the possibility of implementing STEM-PjBL activities in schools so that students can learn across disciplinary boundaries within the STEM subjects.

Despite the many positive views of teachers on the STEM-PjBL approach in teaching science, there are however some challenges that have been raised. One challenge highlighted is the amount of time that teachers need to carry out their projects. This challenge has also been described in the works of Straw et al. (2012), Johari et al. (2013). In addressing this challenge, findings from the views of the teachers suggest that it could be possible for the STEM-PjBL lessons to be carried out after school hours to ensure that teachers have enough time to complete teaching the science syllabus, and students have enough time to complete their projects. Another challenge highlighted by teachers in this study was on the limitation of resources and cost allocated for the projects. For example, in the toy solar car project, apart from using recycled materials, for the chassis of the cars, there is also a need to purchase the motor and solar panels. This is especially obvious when a large amount of materials are needed to cope with 40 to 50 students in a class. This challenge has also been described in the works of Wang et al. (2011), Straw et al. (2012) and Weber et al. (2013). In addressing this challenge, science teachers recommended that students and other stakeholders should take their own initiative in getting the necessary material for science projects, and conducting activities are in smaller groups.

The study also highlighted that the lack of STEM training could be a challenge for a teacher adopting a STEM-PjBL in his or her lessons. The work of Honey et al. (2014) highlights that „STEM‟ is an integration of disciplines, and that knowing only the science or mathematics discipline alone may not be sufficient to execute a STEM-based lesson in the classroom. In order to adopt STEM-PjBL in science teaching, a teacher needs to be well equipped with not only the content knowledge in science or mathematics, but also the instructional skills in delivering science content through a STEM-PjBL (Ferry et al. 2005, and Walker et al. 2011). Wan et al. (2013) has brought up the idea of getting more support for STEM training for Malaysian teachers. The involvement of pre-service and in-service teacher participants in this workshop highlighted that it could be possible for them to be engaged in acquiring pedagogical content knowledge in teaching science through a STEM-PjBL approach.

Because the STEM-PjBL approach offers a different approach to conventional teaching approaches (such as didactic or stepped-through science experiments), training in STEM such as the one conducted in this study has allowed teachers to realize the need to plan STEM-PjBL lessons differently (in advance) especially for students who are not interested in Science. Also, because the STEM-PjBL approach is its interdisciplinary nature, it provides opportunities for teachers to plan on how students can learn across disciplinary boundaries in Mathematics, Physics, Science, Technology, Design and Engineering. Teachers can support students to bridge the gaps between separate learning areas through a single project. The positive views of teachers in this study mirrors those reported in earlier studies (Turgut 2008; Berry et al. 2012), which highlighted that a STEM-PjBL approach would enable students to gain experience in meeting up to problems that exist in the real world which are ill-defined, and ones that require students to draw knowledge from the STEM disciplines. Their views are also similar to the ones highlighted by Weber et al. (2013), in which teachers found that STEM projects act as catalysts to help students think critically and creatively in the STEM subject areas. These attributes such as being able to see links across subjects and being able to think critically and creatively in the STEM domains could contributes to a Malaysian student‟s employability skills and marketability not just locally but also globally.

Implications and Recommendations

Findings from this study indicate that while considerable effort is necessary to put STEM-PjBL approaches into place, STEM-PjBL would provide practical, innovative curriculum development to support the Malaysian Educational Blueprint goals for 2013–2025. Findings from this study also revealed a number of gaps that would be needed to address in terms of training and support for teachers. This study has shown that several teachers have honestly expressed their lack of expertise in conducting STEM-PjBL approaches in their school science classes, one of the reasons being a possible reluctance to move away from conventional modes of teaching. This implies the need for educational institutions to develop more STEM-based training programs for classroom practitioners, particularly in the areas of lesson planning, instruction, STEM content, assessment techniques and fostering creative thinking skills. This could be achieved through on-going in-service STEM professional development programs. Findings also indicated that introducing five STEM-based activities at one time may overwhelm teachers. Introducing STEM-based approaches that use the latest effective teaching styles (such as the STEM-PjBL) a little bit at a time would be one way to address this challenge.

The research suggests the need to revise and re-structure the science and mathematics curriculum to produce students who are capable to think of Science, Technology, Engineering, and Mathematics in the broader terms, and not just as subjects they study in schools or just to pass examinations. There is a need to reform the Malaysian national curriculum to offer ways for students to link STEM subjects to solve real life/world problems. The STEM-PjBL approach as shown through this study can be a way to achieve this goal. Indeed, aspects of the STEM-PjBL approach could relatively easily be infused into the Malaysian national science and mathematics curriculum.

While this may be desirable, the researchers acknowledge that it is not that simple to design a multi-disciplinary project with wide coverage of STEM subjects. The researchers recommend that experts and STEM education researchers plan several multi-disciplinary projects that could present content across subjects such as Mathematics, General Science, Physics, Chemistry, Biology, Design, and Technology to students in schools. Students can then be offered one or two such projects each year, as they work towards meeting a certain curriculum requirement. This may be a practical way to prepare students to be capable of dealing with industrial-related problems when they enter the world of work.

A potential challenge that teachers raised is the amount of time needed to complete STEM projects in their science classes. The researchers found that it is important to provide sufficient time within or outside the curriculum so that the students can carry out their projects well. Also grades should be awarded for these projects based on the work and hours spent on planning and carrying them out. Credits could also be awarded for students who carry out some form of research in how content gained from their STEM projects subjects are applied in the real world.

Findings from this research also highlight an issue about infrastructure constraints. The study suggests that government should allocate sufficient budget to improve facilities and provide necessary equipment to furnish science laboratories to ensure that STEM-PjBL can be effectively achieved. Apart from the education ministry, funds could be contributed by private, STEM-related companies. Other stakeholders in education such as school staff, parents and universities could invite participation and collaboration from STEM-related companies, in

view of building a future nation of STEM-trained students. This could not only develop the possibility of STEM experts and professionals to contribute to the Malaysian and global economy but could also place Malaysia‟s science teaching at a higher level. The researchers believe that when this happens, there would be a positive reflection in Malaysian students‟ performance in TIMSS and PISA results.
Finally, the study highlights a need for scholars to focus more strongly on raising teachers‟ awareness of the interdisciplinary nature of STEM practices and to support the integration of STEM approaches in teaching practices. The Malaysian national curriculum may need to be re-vamped to enable this. Further studies should be carried out in the near future to gain more insights on constructing suitable models for Malaysian STEM education and monitoring these. Potential further research could usefully address our understanding of the obstacles faced by teachers in implementing STEM-PjBL approaches in classrooms perceptions of students toward the STEM projects, and teachers‟ unbiased views of implementing STEM in their classrooms. Researchers will be required to set the standards for STEM education, produce instruments to assess the suitability of STEM-PjBL plans, and produce assessment tools in order to assess student‟s competency in STEM.

Study findings further suggest that involvement of the various education stakeholders, namely teachers, the ministry, STEM-related agencies, institutes of higher learning such as universities, experts and scholars will all be required and valued on the journey to produce STEM-competent students.

Acknowledgements

The research was supported by the University of Malaysia Sabah (UMS), Malaysia under Grant No. GPP0004. Any opinions, viewpoints, findings, conclusions, suggests, or recommendations expressed are the authors and do not necessarily reflect the views of the University of Malaysia Sabah, Malaysia.

References

Abrahams, A., & Millar, R. (2008). Does practical work really work? A study of the effectiveness of practical work as a teaching and learning method in school science. *Int J Sci Educ, 30*(14),1945–1969.

Amir, N. (2014). Showcasing the creative talents in science of the academically less-inclined students through a values-driven toy story-telling project. In: Lennex LC, Nettleton KF (eds). *Cases on Instructional Technology in Gifted and Talented Education*. IGI Global Publishing, USA, pp. 141–179.

Amir, N., & Subramaniam, R. (2006). Making physics toys fosters creativity. *Phys Educ*, *41*(1),18–20.

Amir, N., & Subramaniam, R. (2007). Making a fun cartesian diver: a simple project to engage kinaesthetic learners. *Phys Educ*,*42*(5),478–480.

Amir, N, & Subramaniam, R. (2009). Making a low cost candy floss kit gets students excited about learning physics. *Phys Educ*,*44*(4),420–428.

Amir, N, & Subramaniam, R. (2012). Fostering inquiry in science among kinaesthetic learners through design & technology. In: Lennex LC, Nettleton KF (eds). *Cases on Inquiry Through Instructional Technology in Math and Science: Systemic Approaches*. IGI Global Publishing, USA, pp. 221–257.

Amir, N, & Subramaniam, R. (2014) Presenting physics content and fostering creativity in physics among less academically inclined students through a simple design-based toy project. In: de Silva E (ed). *Cases on Research-Based Teaching Methods in Science Education.* IGI Global Publishing, USA, pp. 157–196.

Anderson, J. (2007). Enriching the teaching of biology with mathematical concepts. *Am Biol Teach, 69*(4), 205–209.

Ayob, A. (2012). *Cara Meningkatkan Minat Pelajar terhadap Sains dan Matematik* [*Ways to Increase Student Interest in Science and Mathematics*], Paper presented in Colloquium on Mathematics and Science Education, Universiti Malaya.

Beane, J.A. (1997). *Curriculum Integration: Designing the Core of Democratic Education*. New York: Teachers College Press.

Berry. M.R., Chalmers, C., & Chandra, V. (2012). STEM futures and practice, can we teach STEM in a more meaningful and integrated way? In: Yu SQ (ed). *2nd International STEM in Education Conference*, 24–27 November, 2012. Beijing, China.

Clark, A.C., & Ernst, J.V. (2007). A model for the integration of science, technology, engineering, and mathematics. *Technol Teach*, *66*(4), 24–26.

Cook, K.L., & Buck, G.A. (2013). Pre-service teachers‟ understanding of the nature of science through socio-scientific inquiry. *Electron J Sci Educ*, *17*(1),1–24.

Drake, S.M. (1991). How our team dissolved the boundaries? *Educ Leadersh*, *49*(2),20–22.

Drake, S.M. (1998). *Creating Integrated Curriculum: Proven Ways to Increase Student Learning*. Corwin, Thousand Oaks, CA.

Elkind, D. (1999). *Dialogue on Early Childhood Science, Mathematics, and Technology Education*. Medford: American Association for the Advancement of Science.

Emerson, R., Fretz, R., & Shaw, L. (1995). *Writing Ethnographic Field-Notes*. Chicago IL: University of Chicago Press.

Erickson, F. (1986). Qualitative methods in research on teaching. In: Wittrock MC (ed) *Handbook of Research on Teaching* (3rd eds.). New York: Macmillan, pp. 119–161.

Featonby, D. (2005). Toys and physics. *Phys Educ*, *40*(6),537–543.

Featonby, D. (2010). Magic physics? *Phys Educ*, *45*(1), 24–31.

Ferry, B., Kervin, L., Cambourne, B., Turbill, J., Hedberg, J., & Jonassen, D. (2005). Incorporating real experience into the development of a classroom-based simulation. *J Learn Des*, *1*(1), 22–32.

Flores, A., Knaupp, J., Middleton, J.A., & Staley, F.A. (2002). Integration of technology, science, and mathematics in the middle grades: a teacher preparation program. *Contemp Issues Tech Teach Educ, 2*(1),31–39.

Fortus D, Krajcik, J., Dershimer, R.C., Marx, R.W., & Mamlok-Naaman, R. (2005). Design-based science and real-world problem solving. *Int J Sci Educ, 27*(7), 855–879.

Foundation, N.S. (2010). *Diversifying the STEM pipeline the model replication institutions program.* Washington DC: Institute for Higher Education Policy.

Gardner, H. (1983). *Frames of Mind: The Theory of Multiple Intelligences*. New York: Basic Books.

Güémez, J, Fiolhais, C., & Fiolhais, M. (2009). Toys in physics lectures and demonstrations - a brief review. *Phys Educ*, *44*(1), 53–64.

Gutstein, E. (2003). Teaching and learning mathematics for social justice in an urban, Latino school. *J Res Math Educ*, *34*(2),37–73.

Hickey, R. (2014). Project-based learning: where to start? *Techniques: Connecting Education & Careers*. *89*(2), 8–9.

Honey, M., Pearson, G., & Schweingruber, H. (2014). STEM Integration in K-12 Education: Status, Prospects, and an Agenda for Research. Committee on Integrated STEM Education: National Research Council, Retrieved from http://www.nap.edu/catalog.php?record_id=18612

Ingram, E.L., & Nelson, C.E. (2006). Relationship between achievement and students‟ acceptance of evolution or creation in an upper-level evolution course. *J Res Sci Teach*, *43*(1), 7–24.

Jacobs, H.H. (1989). *Interdisciplinary Curriculum: Design and Implementation*. Alexandria VA: Association for Supervision and Curriculum Development.

Johari, S., Nor Hasniza, I., & Mahani, M. (2013). Implementation of problem based learning in higher education institutions and its impact on students‟ learning. In: Khairiyah M-Y., Mahyuddin, A., Mohamad Termizi, B., Graaff, E., Kolmos, A., & Fatin Aliah, P., *PBL Across Learning* (eds). Paper presented at Fourth International Research Symposium on PBL 2013, Universiti Teknologi Malaysia, 2–3 July 2013. Aalborg University Press, Denmark, pp. 66–73.

Kangas, M. (2010). Creative and playful learning: learning through game co-creation and games in a playful learning environment. *Think Skills Creativy*, *5*(1), 1–15.

Khair, N., Ahmad Nabil, Md. N., Dayana Farzeeha, A., Mohd Safarin, N. (2011). Problem based Learning (PBL) and Project-based Learning (PjBL) in Engineering Education: A comparison, *Proceedings of the IETEC' 11 Conference*, Kuala Lumpur, Malaysia

Laboy-Rush, D. (2007). *Integrated STEM education through project based learning*. Retrieved from http://www.rondout.k12.ny.us/UserFiles/Servers/Server_719363/File/12-13/STEM/STEM-White-Paper%20101207%20final[1].pdf.

Lan, B.L. (2011). Design Projects in First-Year Physics for Engineering, *Proceedings of the IETEC'11 Conference*, Kuala Lumpur, Malaysia., Retrieved from http://www.ietec-conference.com/ietec11/Conference% 20Proceedings/ ietec/papers/Conference%20Papers%20Refereed/Wendesday/WP3/WP3.1_39.pdf.

Marshall, J., Horton, B., & Austin-Wade, J. (2007). Giving meaning to the numbers. *Sci Teach*, *74*,36–41.

McCullough, J., & McCullough, R. (2000). *The Role of Toys in Teaching Physics*. College Park, MD: American Association of Physics Teachers.

McGartland, G. (1998). Using toys to foster creativity and innovation at work. *Innov Lead*, *7*(3), 330. Retrieved from http://www.winstonbrill.com/bril001/html/article_index/articles/301-350/article330_body.html.

McGervey, J.D. (1995). Hands-on physics for less than a dollar per hand. *Phys Teach*, *33*(4), 238–241.

Meyer, D. (2012). Designing design challenges - getting the details right: using engineering problems to enact inquiry learning. *Sci Teach*, *79*(2), 58–62.

Miller, K.A. (1995). *Curriculum: To Integrate or not to Integrate*. Ohio, USA: Youngstown State University.

Ministry of Education. (2012a). M*alaysia Education Blueprint 2013–2025: A Preliminary Report.* Putrajaya: MOE.

Ministry of Education. (2012b). *Laporan Strategi Mencapai Dasar 60:40 Aliran Sains/Teknikal: Sastera,* [*Strategies to Achieve 60:40 Science/Technical:Arts Stream Policy Report*]. Putrajaya: MOE.

Mujtaba, T., & Reiss, M. (2014). A survey of psychological, motivational, family and perceptions of physics education that explain 15-year-old students' aspirations to study physics in post-compulsory English schools. *Int J Sci Math Educ*, *12*(2),371–393.

Ng, Y.K., Mak, S.Y., & Chung, C.M. (2002). Demonstration of Newton"s third law using a balloon helicopter. *Phys Teach*, *40*, 181–182.

Nielsen, M.E. (1989). Integrative learning for young children: a thematic approach. *Educ Horiz*, *68*(1),18–24.

OECD. (2014). *PISA 2012 Results in Focus*. Retrieved from http://www.oecd.org/pisa/keyfindings/pisa-2012-results-overview.pdf.

Oliver, D., & Ng, T. (1999). Rubber-band-driven airplane contest. *Phys Teach, 37*(2),108.

Paige, K., Lloyd, D., & Chartres, M. (2008). Moving towards transdisciplinarity: an ecological sustainable focus for science and mathematics pre-service education in the primary/middle years. *Asia Pac J Teach Educ*, *36*(1),19–33.

Parker-Rees, R. (1997). International Conference on Design and Technology Educational Research and Curriculum Development, Loughborough University of Technology., pp 20–25, Retrieved from https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/1458/3/parkerrees97.pdf.

Park-Rogers, M., Volkmann, M., & Abell, S. (2007). Science and mathematics: a natural connection. *Sci Child*, *45*(2),60–61.

Phang, F.A., Abu, M.S., Ali, M.B., & Salleh, S. (2012). *Faktor Penyumbang Kepada Kemerosotan Penyertaan Pelajar Dalam Aliran Sains: Satu Analisis Sorotan Tesis* [*Contributing factors to the decline in student participation in Science Stream: A Thesis Highlights Analysis*]. Skudai: Universiti Teknologi Malaysia.

Phillips, A.P., Palazolo, P.J., Magun, J.S., Camp, C.V., & Schmucker, D. (2002). Powerful Play: Using Toys as Tools in Engineering Education. *Proceedings of the 2002 American Society for Engineering Education Annual Conference and Exposition*, American Society for Engineering Education., Retrieved from http://search.asee.org/search/fetch?url=file%3A%2F%2Flocalhost%2FE%3A%2Fsearch%2Fconference%2F26%2FAC%25202002Paper1050.pdf&index=conference_papers&space=129746797203605791716676178&type=application%2Fpdf&charset=.

Resnick M, Berg R, & Eisenberg M (2000) Beyond black boxes: bringing transparency and aesthetics back to scientific investigation. *J Learn Sci*, *9*(1),7–30.

Rogers C, & Portsmore M (2004) Bringing engineering to elementary school. *J STEM Educ, 5*(3),17–28.

Sabin, J.R., Trujillo, R.C., Öhrn, Y., & Deumens, E. (2008). Theoretical investigation of fragmentation effects in the energy deposition of swift ions in formaldehyde. J. Phys.: Conf. Ser. 101 012009. doi:10.1088/1742-6596/101/1/012009.

Sarquis, J., Sarquis, M, & Williams, J.P. (1995). *Teaching chemistry with TOYS: activities for grades K-9.* USA: McGraw-Hill, Learning Triangle Press.

Sarquis, J., Hogue, L., Sarquis, M., & Woodward, L. (1997). *Investigating Solids Liquids and Gases with Toys*. Middletown: McGraw-Hill, Miami University.

Satchwell, R.E., & Loepp, F.L. (2002). Designing and implementing an integrated mathematics, science and technology curriculum for the middle school. *J Ind Teach Educ, 39*(3).

Sills, T.W. (1999). *Science fun with Toys*. Chicago: Dearborn Resources.

Stables, K. (1997). Critical issues to consider when introducing technology education into the curriculum of young learners. *J Technol Educ*, *8*(2),50–65.

Straw, S., MacLeod, S., & Hart, R. (2012). Evaluation of the Wellcome Trust Camden STEM initiative. Slough: NFER.

Subramaniam, R., & Ning, H.T. (2004). Pendulums swing into resonance. *Phys Educ*, *39*(5), 395.

Sumners, C. (1997). *Toys in space: exploring science with the astronauts*. Blue Ridge Summit, PA: McGraw-Hill.

Taylor, B.A.P., Poth, J., & Portman, D.J. (1995). *Teaching physics with toys: activities for grades K-9*. Middletown: OH Terrific Science Press.

Teo, T. (2008). Pre-service teachers" attitudes towards computer use: a Singapore survey. *Australas J Educ Technol*, *24*(4),413–424.

Thompson, G., & Mathieson, D. (2001). The mirror box. *Phys Teach*, *39*(8),508–509.

Turgut, H. (2008). Prospective science teachers" conceptualizations about project based learning. *Int J Instruct, 1*(1),61–79.

Walker A, Recker, M., Robertshaw, M.B., Olsen, J., Leary, H., Ye, L., & Sellers, L. (2011). Integrating technology and problem-based learning: A mixed methods study of two teacher professional development designs. *Interdiscip J Prob Based Learn*, *5*(2),70–94.

Wan, A., Wan, A., Roslina, S., Ruhizan Mohammad, Y., Saemah, R., Khairiyah Mohd, Y., Nor Kamariah, N., & Mohd Saleh, J. (2013). An exploratory study on the implementation of POPBL among lecturers of higher education institutions in Malaysia. In: Khairiyah M-Y, Mahyuddin A, Mohamad Termizi B, Graaff E, Kolmos A, & Fatin Aliah P, *PBL Across Learning* (eds) Paper presented at Fourth International Research Symposium on PBL 2013, UniversitiTeknologi Malaysia, 2–3 July 2013. Aalborg University Press, Denmark, pp 61–65.

Wang, H.H.,Moore,T.J, Roehrig, G.H., & Park, M.S. (2011). STEM integration: teacherperceptions and practice. *Journal of Pre-College Engineering Education Research*, *1*(2),1–13.

Weber, E., Fox, S., Levings, S.B., & Bouwma-Gearhart, J. (2013). Teachers‟ conceptualizations of integrated STEM. *Acad Exchange*, *17*(3),47–53.

Yau, C.M., & Wong, V.P. (2004). Using Toys To Teach Science, *Proceedings of the Educational Research*

Zubrowski, B. (2002). Integrating science into design technology projects: using a standard model in the design process. *J Technol Educ, 13*(2), 48–67.

Zwiep, S.G., & Benken, B.M. (2013). Exploring teacher's knowledge and perceptions across mathematics and science through content rich learning experiences in a professional development setting. *Int J Sci Math Educ*, *11*(2), 299–324.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 23-27

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Pre-Service Teachers' STEM Perspectives and STEM Integrations

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Abstract: In order to have a STEM implemented class, teachers need to hold certain skills and knowledge so that they can integrate technology and engineering concepts into their classroom practices. Learning science through engineering is challenging. If pre-service teachers' thinking about STEM is understood, more collective and instructional representation related to pre-service science teachers' learning about STEM education can be obtained. Therefore, for effective integration it is helpful to understand how pre-service teachers conceptualize STEM education. The purposes of this research were to identify pre-service physics teachers' STEM perspectives and to examine role of their perspectives in their STEM integration. Multiple case study design was implemented for this research. The participants were pre-service physics teachers enrolling in a state university. Pre-Service Teacher STEM Education Survey was used to determine the participants' STEM perspectives. Their lesson plans were examined to understand how they made STEM integration. Interviews were conducted to comprehend the role of pre-service teachers' perspectives in their integration. The participants' STEM perspectives were categorized as nested, transdisciplinary, interconnected, sequential, overlapping, and siloed. Engineering design process and real-world problem could be seen obviously in the lesson plans of the participants having transdisciplinary perspective. However, the participants seeing STEM components as sequential could not reflect this process to their lesson plans and wrote open-ended physics questions instead. Some participants whose perspectives could be categorized as soiled could not write performance goals and concepts to be taught. Results can be valuable in constructing theoretical framework of STEM education in teacher education programs.

Keywords: STEM, Pre-service Teachers, Perspective, Integration

Introduction

Bybee (2013), whose definition was adopted for this study, leaves STEM ill-defined and suggests that the most accurate definition may come from one's personal context and needs and explains the perspectives of nine different STEM education through visual presentations. Bybee (2013) offers a range of models to describe STEM education from various educational perspectives, ranging from STEM as a replacement acronym for science or mathematics to STEM as representing true integration across all four fields. He presents eight approaches for integration with a focus on STEM education. In these approaches, STEM refers to (a) science (or mathematics); (b) both science and mathematics; (c) science and the incorporation of technology, engineering, or mathematics; (d) a quartet of separate disciplines of science, mathematics, engineering, and technology; (e) science and mathematics that are connected by a technology or engineering program; (f) coordination across disciplines; (g) combining two or three disciplines; (h) complementary overlapping across disciplines; (i) a transdisciplinary course or program. Bybee demonstrates that this integration can be done in different ways as STEM 1.0 (single discipline), STEM 2.0 (two disciplines), STEM 3.0 (three disciplines) and STEM 4.0 (four disciplines) in creating the STEM curriculum. He states that these integrations can be done in five different ways such as coordinating, complementary, associating, linking and integrating. Bybee's integration model was obtained for this study.

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

How teachers conceptualize, interpret, and subsequently enact STEM content and engineering impacts the learning experiences they provide in their classrooms (Diefes-Dux 2014). Although pre-service STEM teacher education should include STEM content, pedagogy, and conceptualization, the literature suggests no leading conception of STEM education, and little is known about teachers' thinking about STEM (Radloff & Guzey, 2016). More research is needed to identify teachers' beliefs about and conceptions of STEM to provide professional development for teachers about STEM integration. Therefore, the purposes of this research were to identify pre-service physics teachers' STEM perspectives and to examine role of their perspectives in their STEM integration.

Methodology

Multiple case study design was carried out for this research (Yin, 2014). The participants were 14 pre-service physics teachers enrolling in a state university. Four of them were male.

The implementation lasted 14 weeks under the STEM Education course prepared for the pre-service physics teachers. In the first week of the course, philosophy of STEM education was discussed. The Framework for K-12 Science Education ((NAE & NRC, 2014) lists five major ideas that are essential to the design of STEM learning environments and curriculum resources: 1) identifying a limited number of core disciplinary ideas of science, 2) using crosscutting concepts, 3) engaging students in scientific and engineering practices, 4) building integrated understanding across time, and 5) coupling scientific ideas, crosscutting concepts and scientific and engineering practices to develop integrated understanding. These five ideas were considered in planning the activities. Design-based science learning (Fortus et al., 2004) framed the study. The participants experienced engineering design based challenges, STEM design challenges, and thinkering activities by doing the following activities: Making the highest tower with spaghettis, my soup does not get cold, my egg does not break, walking bug, cars that are made with balloons, and the fastest roller coaster. The participants identified the problem, defined what is given by the problem, produced possible solutions, developed a prototype to show their solutions, and received feedback from their classmates

Various sources were used to collect data. Teachers' STEM Perspective Survey (Radloff & Guzey, 2016) comprised of 12 questions was administered to understand the participants' STEM perspectives. The survey included four closed-ended questions, two multiple-choice style questions, five open-ended questions, and one question utilizing a Likert scale. Radloff and Guzey (2016) designed the survey to gather information from teachers about their conceptualization of STEM education, to learn what STEM looks like to teachers from their illustrations, and to obtain a rationale for their illustration. Hence, the participants were asked to make a diagram or schema about how they figured out STEM education by using the letters S, T, E, M.

In order to assess the participants' STEM integration, each of them prepared a STEM lesson plan at the end of the course. STEM lesson plan rubric out of 100 was used to analyze their lesson plans and to capture how they made STEM integration. The participants' STEM perspectives were categorized as nested, transdisciplinary, interconnected, sequential, overlapping, and siloed (Bybee, 2013). Nested visualizations signify a view of STEM in which there is one overarching discipline (Radloff & Guzey, 2016). Transdisciplinary visualizations suggest a focus on the real-world, application-based nature of STEM and a completely integrated view of STEM (Radloff & Guzey, 2016). In interconnected visualizations, concepts, processes, and resources are coordinated across boundaries to separate disciplines (Bybee, 2013). Sequential visualizations follow most closely with conceptualizations of STEM as a series of or successive STEM disciplines (Radloff & Guzey, 2016). Overlapping visualizations show two overarching subjects, connected by lesser subjects (Radloff & Guzey, 2016). Siloed visualizations portray the way STEM is historically taught in schools—in isolation of each other (Radloff & Guzey, 2016). Interviews were conducted to comprehend the role of pre-service teachers' perspectives in their integration.

Results

As shown in Table 1, while five out of 14 participants had the instructional perspective, three of them had the transdisciplinary perspective, two of them had siloed perspective and the rest of two had sequential perspective. Whereas one participant had nested perspective the other one had interconnected perspective. Instructional perspectives, which are drawn from the data of this study, demonstrate an understanding of STEM directly involving teaching or learning method and problem solving path. As a result, six different visual representations of the perspectives were obtained.

Table 1. Perspectives, disciplines, integration and lesson plan scores of the participants

PARTICIPANT	PERSPECTIVE	DISCIPLINES	INTEGRATION	LESSON PLAN
Alfred	Instructional	PTEM	STEM 4.0	90
Zack	Instructional	PEM	STEM 3.0	81
Barbara	Siloed	PE	STEM 2.0	48
Nancy	Transdisciplinary	PTEM	STEM 4.0	92
Gabby	Transdisciplinary	PTEM	STEM 4.0	77
Calvin	Sequential	P	STEM 1.0	30
Aoron	Siloed	PM	STEM 2.0	43
Fatima	Instructional	PE	STEM 2.0	47
Sandy	Sequential	P	STEM 1.0	30
Ferdinand	Transdisciplinary	PEM	STEM 3.0	60
Rebecca	Nested	PEM	STEM 3.0	79
Oliver	Instructional	PEM	STEM 3.0	67
Nadia	Instructional	PE	STEM 2.0	59
Debby	Interconnected	PEM	STEM 3.0	66

P = Pyhsics, E = Engineering, M = Maths, T = Technology

Five participants having instructional perspective could reach STEM 4.0, STEM 3.0 and STEM 2.0 integration. One of them having STEM 4.0 integration thought that STEM was a new teaching method. The other one having STEM 3.0 integration believed that STEM was a learning method. Another one having STEM 2.0 integration thought that STEM was problem solving path or method. He needed to apply technology and to determine target grade, standards and mathematical thinking in his integration. One of the remaining two participants having instructional perspective could reach STEM 3.0 and needed to support in technology usage and preparation of STEM activity sheet for the students. Other remaining participant having instructional perspective could reach STEM 2.0 and needed technology and mathematical thinking support.

Transdisciplinary perspective represents a combination of all disciplines. For instance, as seen in Figure 1, the participant having this perspective brought science, technology, engineering and math from separate sources and combined them in one single box. Three participants having transdisciplinary perspectives could make engineering design, test their design, collect data, use technology, and have computing thinking. Hence, they could reach STEM 3.0 and STEM 4.0 integration models. They did not separate STEM disciplines from each other.

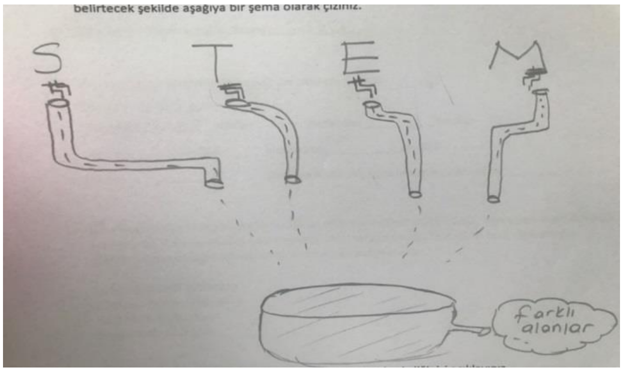

Figure 1. An example of transdisciplinary visual representation

Sequential perspective defines conceptualization of STEM as a series of the included disciplines. As can be seen in Figure 2, disciplines are represented in an order. Two pre-service teachers seeing STEM components as sequential needed to support in engineering design skills and computing thinking. They did not utilize technology. Therefore, they had STEM 1.0 integration model. They could not reflect this process to their lesson plans and wrote open-ended physics questions instead.

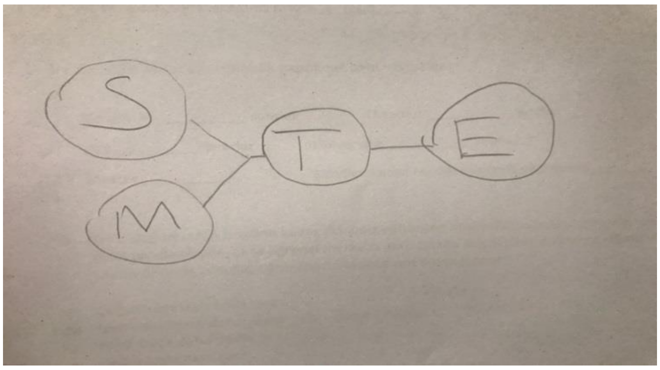

Figure 2. An example of sequential visual representation

On the other hand, one participant having siloed perspective whose visual representation is shown in Figure 3 used physics knowledge and engineering design while the other one used physics knowledge and computing thinking together. As a result, they could reach STEM 2.0 integration model. They did not benefit from technology. They could not write purposes of the lesson, performance goals, and concepts to be taught.

Since nested perspectives explain a visualization of STEM in which there is one inclusive discipline, the participant whose visual representation is displayed in Figure 4, combined all the disciplines under mathematics. This participant having nested perspective needed to support in technology using. She could reach STEM 3.0 integration.

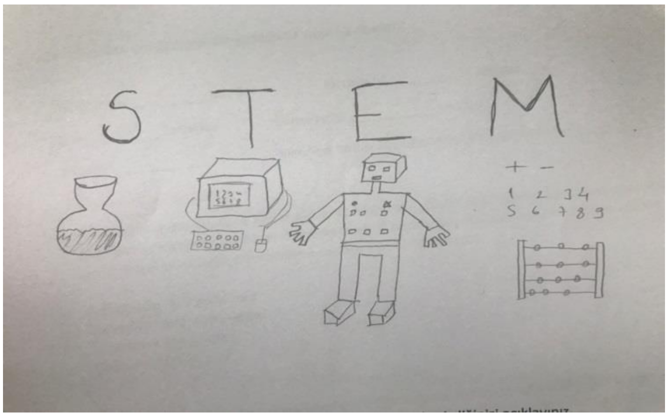

Figure 3. An example of siloed visual representation

Since nested perspectives explain a visualization of STEM in which there is one inclusive discipline, the participant whose visual representation is displayed in Figure 4, combined all the disciplines under mathematics. This participant having nested perspective needed to support in technology using. She could reach STEM 3.0 integration.

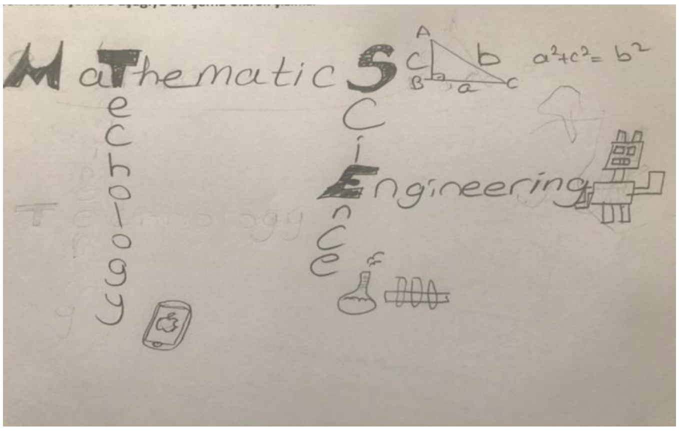

Figure 4. An example of nested visual representation

Implication and Suggestions

Results of this research can be valuable in constructing theoretical framework of STEM education in teacher education programs. Teachers' transdisciplinary perspective should be supported since it facilitates solving authentic problems. Teachers' knowledge of instructional technology should be improved. Inquiry based learning, problem based learning and project based learning should be implemented in teacher education to enhance teachers' STEM pedagogy.

References

Bybee, R. (2013). *The case of STEM education: Challenges and opportunities*. Arlington, TX: NSTA Press.

Diefes-Dux, H. A. (2014). In-service teacher professional development in engineering education: Early years. In S. Purzer, J. Strobel and M. E. Cardella (Eds.), *Engineering in precollege settings: Synthesizing Research, Policy, and Practices.* West Lafayette, IN: Purdue University Press.

Fortus, D., Dershimer, R. C., Marx, R. W., Krajcik, J., & Mamlok-Naaman, R. (2004). Design-based science (DBS) and student learning. *Journal of Research in Science Teaching, 41*(10), 1081–1110.

National Academy of Engineering and National Research Council. (2014). STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research. Washington, DC: The National Academies Press.

Radloff, J., & Guzey, S. (2016). Investigating Preservice STEM Teacher Conceptions of STEM Education. *Science Education Technology, 25*, 759–774.

Yin, R. K. (2014). *Case study research*. Thousand Oaks, CA: Sage.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 28-35

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Technology in Mathematics and Science Distance Education: Automated Textual Analysis of Articles and Proceedings Papers using *Leximancer*

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Abstract: This paper presents an analysis of 30 recent journal articles and proceedings papers addressing the use of technology in mathematics and science distance education. The analysis is performed using *Leximancer* (2017), an automated textual analytics tool. The study asks, 1) "Which concepts occur most frequently relative to each discipline?"; 2) "How do frequent concepts vary between the disciplines?"; 3) "Which themes emerge as most characteristic of this discourse"; and "What do the disciplinary document sets have in common?". The findings offer strong evidence in support of a conjecture that discourse associated with the use of technology in distance education is conducted by mathematics and science education scholars using systematically different concepts and themes to represent their interests, methods, and findings.

Keywords: Technology, Distance, Mathematics, Science, Education

Introduction

Worldwide, mathematics and science teachers are using network based informational, computational, modeling, and communication technologies to facilitate teaching and learning at the elementary, secondary, and university levels. A growing corpus of scholarship investigating this phenomenon is focused on technology's role in distance mathematics and science education. This preliminary study characterizes that discourse in terms of the concepts used by each discipline to represent its interests, methods, and findings as seen in 15 mathematics and 15 science education journal articles and proceedings papers. The study asks

1. Which concepts occur most frequently relative to each discipline?
2. How do frequent concepts vary between the disciplines?
3. Which themes emerge as most characteristic of this discourse?
4. What do the disciplinary document sets have in common?

Background

The storehouse of human knowledge and experience is vast, complex, messy, and growing exponentially. To cope with the information explosion, scholars in many knowledge domains rely on sophisticated information technologies to search for and retrieve records and publications pertinent to their research interests. But what is a scholar to do when a search identifies hundreds of documents, any of which might be vital or irrelevant to his/her work? More and more, scholars are turning to automated content analysis technologies to achieve what they do not have time to do themselves; characterize a large corpus of work and identify relationships between significant concepts and themes (Thomas, 2014).

There are several reasons why one would want an automated system for content analysis of documents (Smith & Humphreys, 2006). Researchers are subject to influences that they are unable to report which may lead to subjectivity in data analysis and the interpretation of findings (Nisbett & Wilson, 1977). Limiting researcher subjectivity often involves extensive investments of time and money to address interrater reliability and other sources of bias. One goal of automated content analysis is to reduce this cost and to allow more rapid and frequent analysis and reanalysis of text. A related goal is to facilitate the analysis of massive document sets and to do so unfettered by *a priori* assumptions or theoretical frameworks used by the researcher, consciously or unconsciously, as a scaffold for the identification of concepts and themes in the data (Zimitat, 2006). Since textual analysis technologies operate directly on words (as well as other symbols), a rationale for inducing relationships between words is needed. Beeferman, Berger, & Lafferty (1997) observed that words tend to correlate with other words over a certain range within the text stream. Indeed, a word may be defined by its context in usage (Leydesdorff & Hellsten, 2006). For instance, few Americans would have trouble completing the sentence "A breakfast food of lightly fried batter disks served with butter and syrup is called a …"

Using Bayesian statistical methods, *Leximancer* automatically extracts a dictionary of terms from source documents, discovers concepts, and constructs a thesaurus of terms associated with each concept using Boolean algorithms. Concepts identified this manner are unbiased, robust statistical artifacts and are depicted graphically in *Leximancer* as concept spanning trees. In these trees, concepts appear as circular nodes, frequent co-occurrences appear as segments, and concept nodes positioned near to one another co-occur more frequently than more widely separated concepts. Document files are positioned in the trees using similar principles to facilitate identification and interpretation of relationships between concepts and documents.

Sampling

The selection of sample documents used in this preliminary study was neither strictly random nor formally structured. Sample documents were drawn from the *Learning and Technology Library* (2017) of the *Association for the Advancement of Computing in Education* (AACE, 2017). This database contains over 100,000 articles, proceedings papers, dissertations, books, and other scholarly works focused on learning and technology. The search was conducted using two Boolean expressions: "mathematics education" AND "distance education" AND technology from:2015 to:2017; and "science education" AND "distance education" AND technology from:2015 to:2017. From the identified documents, a total of 15 mathematics and 15 science related articles and proceedings papers were selected and downloaded (See Appendix).

Methods and Findings

Initially, all sample documents were loaded into *Leximancer* and treated as separate files. The graphical output of that analysis appears in Figure 1. In this *concept spanning tree*, frequently co-occurring concepts are positioned near one another. Files positioned near one another share frequently occurring concepts. This representation is useful for identifying which documents are most closely associated with a given concept or set of concepts.

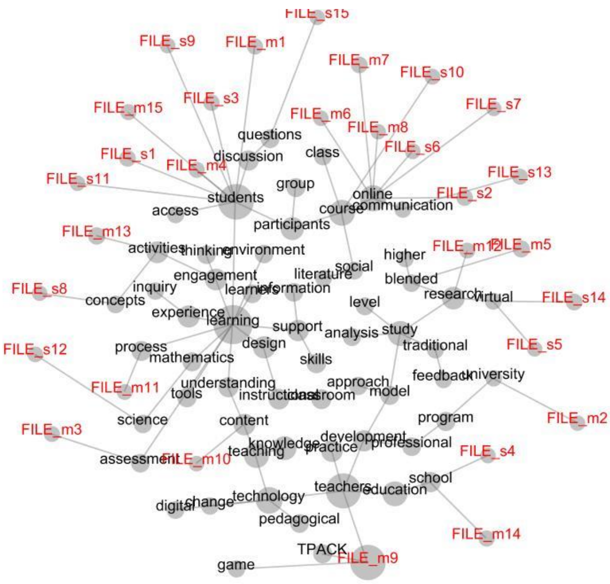

Figure 1. Spanning tree showing concepts & data files

In a second analysis, all mathematics documents were treated as if they were a single document, FOLDER1_mfiles, and all science documents as if they were a single document, FOLDER1_sfiles. This analysis generated a more telling graphic (see Figure 2) relative to the systematic differences between the mathematics and science education papers.

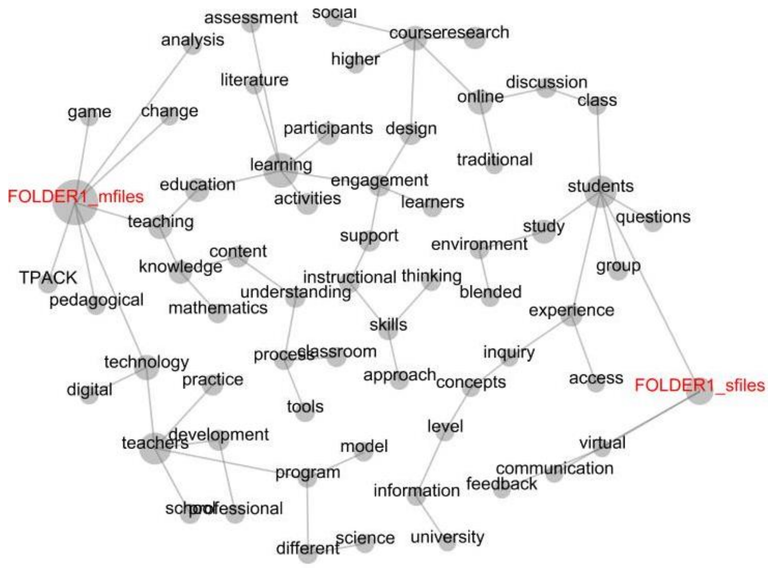

Figure 2. Spanning tree showing concepts & data sets

The second analysis was also used to identify which concepts occur most frequently in the mathematics and science folders. In ranked order from most to least frequent, the concepts discovered in the mathematics documents were "mathematics, course, problem, content, thinking, number, strategies, framework, social, development, professional, technology, pedagogical, education, context, question, approach, project, ideas, knowledge, role, focus, experiences, understanding, school, collaborative, students, skills, learning, teachers, practice, potential, groups, online, study, analysis, activities, example, process, evidence, classroom, concepts, instruction, inquiry, curriculum, level, issues, model, different, research, support, data, design, change, information, nature, materials, tools, environmental, beliefs, science, and chemistry." The concepts discovered most frequently in the science documents were, "chemistry, science, beliefs, environmental, tools, materials, nature, information, change, design, data, support, research, different, model, issues, level, curriculum, inquiry, instruction, concepts, classroom, evidence, process, example, activities, analysis, study, online, groups, potential, practice, teachers, learning, skills, students, collaborative, school, understanding, experiences, focus, role, knowledge, ideas, project, approach, question, context, education, pedagogical, technology, professional, development, social, framework, strategies, number, thinking, content, problem, course, and mathematics."

Table 1. Most frequent concepts: mathematics

Concept	Count	Likelihood %
mathematics	286	94
pedagogical	236	90
digital	213	87
assessment	291	86
game	214	85
participants	572	82
knowledge	571	82
teaching	663	82
content	414	81
school	390	81

Table 2. Most frequent concepts: science

Concept	Count	Likelihood %
virtual	136	71
access	110	51
communication	85	50
science	149	49
blended	97	45
feedback	79	45
inquiry	82	44
skills	150	44
environment	115	44
model	138	42

Tables 1 and 2 list the 10 most frequently occurring concepts in each folder. In these tables, the *Count* associated with a given concept (e.g., mathematics) is the number of times (e.g., n= 286) it occurs in the indicated document folder (e.g., Mathematics Documents). The *Likelihood %* indicates the % (e.g.,94%) of documents in the indicated folder (e.g., Mathematics Documents) containing the given concept (e.g., mathematics).

Next, the concept spanning tree seen in Figure 2 was overlain with a set of 5 colored circles, applied editorially by *Leximancer,* to denote clusters of concepts called themes (see Figure 3).

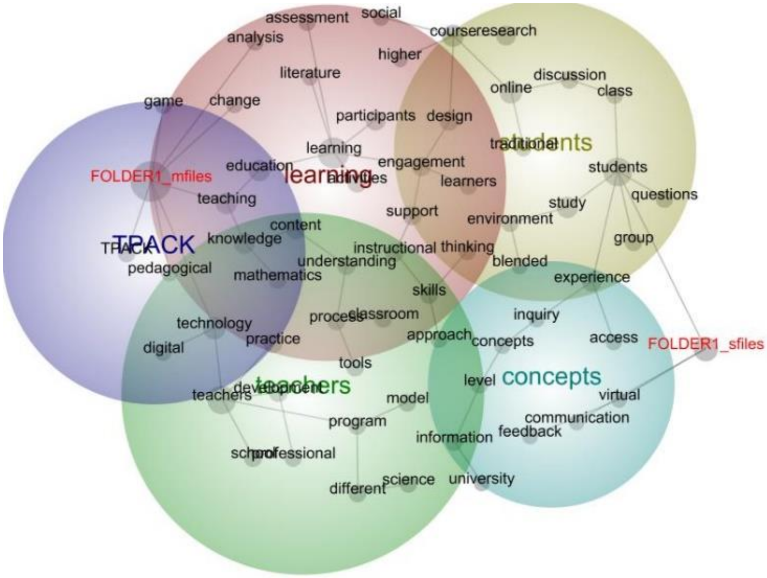

Figure 3. Emergent themes graphic 1

With the concept labels removed (see Figure 4), theme labels are more easily seen. The themes are automatically heat-mapped, meaning that hot colors (red, orange, yellow) denote the most important themes, and cool colors (blue, green), denote those less important. Table 3 presents a summary of these themes with their *Connectivity* score, which is used to assign coloring in Figure 4. Note that the acronym TPACK refers to *Technology, Pedagogy, And Content Knowledge.*

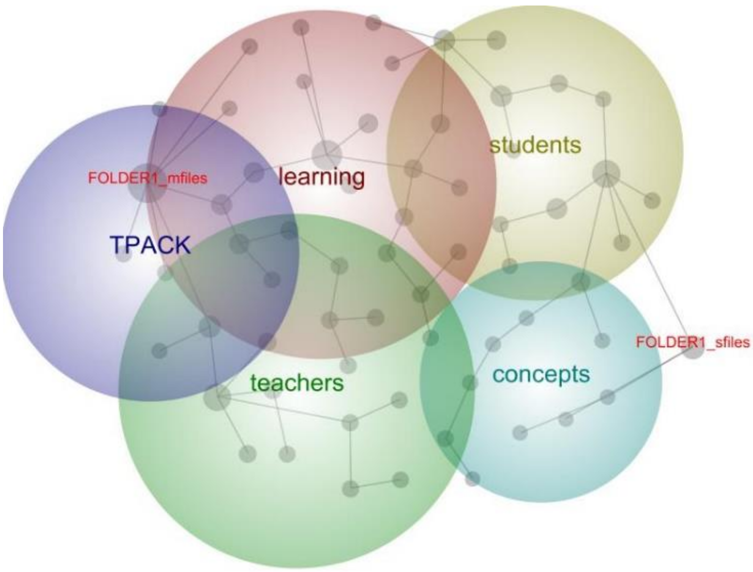

Figure 4. Emergent themes graphic 2

Table 3. Emergent themes summary

Theme	*Connectivity*
Learning	100%
Students	83%
Teachers	70%
Concepts	12%
TPACK	10%

A final analysis was performed to address the question, “Which pathway through the network spanning tree bridges the two folders most directly?” *Leximancer* will automatically generate such a Knowledge Pathway, given its beginning and ending concepts or files. In addition to the graphical representation of the path seen in Figure 5, Leximancer also lists the path segments and *Contribution* scores, best thought of as correlations (see Figure 6). This list is like a narrative of text segments along the path.

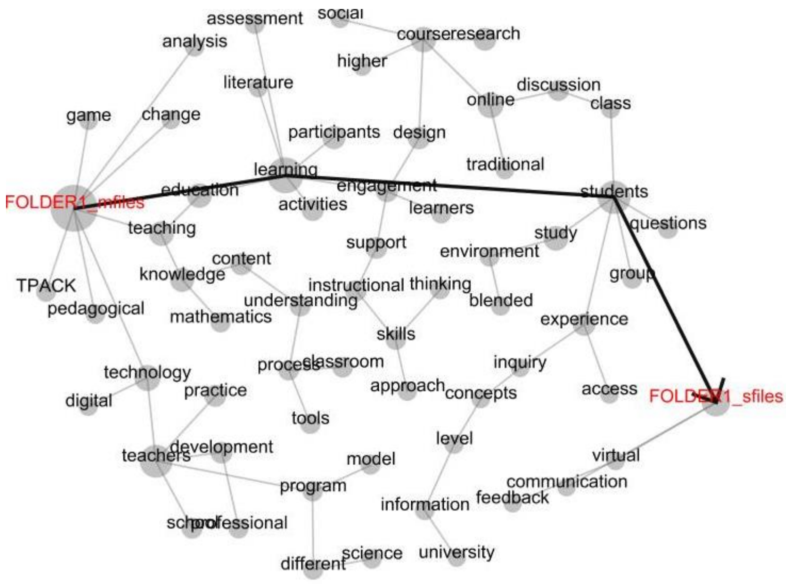

Figure 5. Knowledge pathway graphic

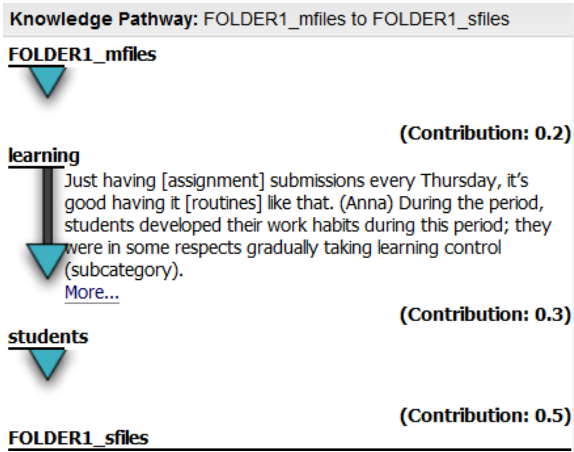

Figure 6. Knowledge pathway contributions

Discussion

Research Question 1 asks, "Which concepts occur most frequently relative to each discipline?" In the analysis, *Leximancer* discovered 1 *name-like* concept (TPAK) and 62 *word-like* concepts. Those concepts appear in Figure 2. Concepts frequently occurring in the mathematics education documents are found close to the FOLDER1_mfiles icon. Concepts frequently occurring in the science education documents are found close to the FOLDER2_sfiles icon. Since, in general, proximity reflects frequency of co-occurrance, nearby concepts (e.g., *content* and *knowledge*) co-occur more frequently than distant concepts (e.g., *content* and *feedback*). Lists of the 10 most frequent concepts associated with the mathematics and science education documents appear in Tables 1 & 2, respectively.

Research Question 2 asks, "How do frequent concepts vary between the disciplines?" In Figure 2, the diametrical positioning of the FOLDER1_mfiles and FOLDER1_sfiles icons relative to the concept spanning tree strongly suggests a differential use of concepts in the mathematics and science documents. Comparing Tables 1 & 2, it is noteworthy that none of the 10 most frequently occurring concepts in the mathematics documents appear in the corresponding list of science documents, and vice versa.

Research Question 3 asks, "Which themes emerge as most characteristic of this discourse?" Themes aid interpretation by grouping clusters of related concepts and representing them as colored circles. Figures 3 & 4 and Table 3 offer one perspective on how clusters of concepts are related. In this case, the themes *Learning, Students, Teachers, Concepts* and *TPACK* provide a useful basis for partitioning 62 concepts into familiar categories. It should be noted that, unlike concepts, themes are not robust statistical artifacts but editorial overlays selected by the researcher within *Leximancer* and generated using consistent procedures related to the number of themes displayed.

Research Question 4 asks, **"**What do the disciplinary document sets have in common?" Figures 5 & 6 suggest that *learning* and *students* appear in both the mathematics and science education documents more frequently than other concepts.

Conclusion & Recommendation

This study found strong evidence in support of a conjecture that discourse associated with the use of technology in distance education is conducted by mathematics and science education scholars using systematically different concepts and themes to represent their interests, methods, and findings. The author is interested in extending this study using a larger, structured sample of documents and involving the participation of other researchers. Please contact the author if you are interested in this venture.

References

AACE (2017). *Association for the Advancement of Computing in Education.* Waynesville, NC 28786 USA. www.aace.org

Beeferman, D., Berger, A., & Lafferty, J. (1997, July). A model of lexical attraction and repulsion. In *Proceedings of the eighth conference on European chapter of the Association for Computational Linguistics* (pp. 373-380). Association for Computational Linguistics.

Learning and Technology Library (2017). *Association for the Advancement of Computing in Education (AACE).*www.learntechlib.org/

Leximancer (2017) (Version 4.0). Leximancer Pty Ltd, Brisbane, Australia. [Software] Available from https://info.leximancer.com/

Leydesdorff, L., & Hellsten, I. (2006). Measuring the meaning of words in contexts: An automated analysis of controversies about 'Monarch butterflies, "Frankenfoods,' and 'stem cells'. *Scientometrics*, *67*(2), 231-258.

Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological review*, *84*(3), 231.

Smith, A. E., & Humphreys, M. S. (2006). Evaluation of unsupervised semantic mapping of natural language with Leximancer concept mapping. *Behavior research methods*, *38*(2), 262-279.

Thomas, D. 2014. Searching for significance in unstructured data: Text mining with Leximancer. *European Education Research Journal***,** 13(2), 2014.

Zimitat, C. (2006). A lexical analysis of 1995, 2000 and 2005 Ascilite conference papers. In *Proceedings of the 23rd Annual Ascilite Conference: Who's learning* (pp. 947-951).

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Appendix: Mathematics and Science Documents (See Figure 1)

M1 Alpay, N., Ratvasky, P., Koehler, N., LeVally, C. & Washington, T. (2017). Redesigning a statistical concepts course to improve retention, satisfaction, and success rates of non-traditional undergraduate students. *Journal of Educational Multimedia and Hypermedia, 26*(1), 5-27. Waynesville, NC USA: Association for the Advancement of Computing in Education (AACE).

M2 Balter, O. (2017). Moving Technology-Enhanced-Learning Forward: Bridging Divides through Leadership. *The International Review of Research in Open and Distributed Learning, 18*(3). Athabasca University Press.

M3 Chiappe, A., Pinto, R. & Arias, V. (2016). Open Assessment of Learning: A Meta-Synthesis. *The International Review of Research in Open and Distributed Learning, 17*(6). Athabasca University Press.

M4 Gillow-Wiles, H. & Niess, M. (2017). Development of Social Presence in an Online Masters Degree Program: Engaging a Workbench Dialectic Inquiry Model. In P. Resta & S. Smith (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference* (pp. 2327-2335). Austin, TX, United States: Association for the Advancement of Computing in Education (AACE).

M5 Greene, K. & Hale, W. (2017). The State of 21st Century Learning in the K-12 World of the United States: Online and Blended Learning Opportunities for American Elementary and Secondary Students. *Journal of Educational Multimedia and Hypermedia, 26*(2), 131-159. Waynesville, NC USA: Association for the Advancement of Computing in Education (AACE).

M6 Kaminski Mumford, J. & Lenarz, M. (2017). Dynamic Design, Development, and Delivery: Best Practices for Online Graduate Education Courses. In P. Resta & S. Smith (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference* (pp. 526-531). Austin, TX, United States: Association for the Advancement of Computing in Education (AACE).

M7 Lee, J. & Martin, L. (2017). Investigating Students' Perceptions of Motivating Factors of Online Class Discussions. *The International Review of Research in Open and Distributed Learning, 18*(5). Athabasca University Press.

M8 Lenarz, M. & Mumford, J. (2016). Dynamic Design and Implementation: Best Practices for Online Graduate Education Courses. In *Proceedings of E-Learn: World Conference on E-Learning* (pp. 179-183). Washington, DC, United States: Association for the Advancement of Computing in Education (AACE).

M9 Liu, L. & Gibson, D. (2016). *Research Highlights in Technology and Teacher Education 2016*. Society for Information Technology & Teacher Education.

M10 Luebeck, J., Cobbs, G. & Scott, L. (2015). Closing the Distance: Online Learning for Rural Mathematics Teachers. In D. Rutledge & D. Slykhuis (Eds.), *Proceedings of SITE 2015--Society for Information Technology & Teacher Education International Conference* (pp. 55-60). Las Vegas, NV, United States: Association for the Advancement of Computing in Education (AACE).

M11 Niess, M. & Gillow-Wiles, H. (2016). Blending Pedagogical Examinations and Discourse with Teachers' Practical Experiences for TPACK Transformation. In G. Chamblee & L. Langub (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference* (pp. 2989-2995). Savannah, GA, United States: Association for the Advancement of Computing in Education (AACE).

M12 Ouyang, F. (2015). Exploring an Experienced Online Instructor's Applications of TPACK in a Graduate-level Online Course Through the Online Students' Perspectives: Design of a Qualitative Case Study. In S. Carliner, C. Fulford & N. Ostashewski (Eds.), *Proceedings of EdMedia 2015--World Conference on Educational Media and Technology* (pp. 291-299). Montreal, Quebec, Canada: Association for the Advancement of Computing in Education (AACE).

M13 Pape, S.J., Prosser, S.K., Griffin, C.C., Dana, N.F., Algina, J. & Bae, J. (2015). Prime Online: Developing Grades 3-5 Teachers' Content Knowledge for Teaching Mathematics in an Online Professional Development Program. *Contemporary Issues in Technology and Teacher Education, 15*(1), 14-43. Waynesville, NC USA: Association for the Advancement of Computing in Education (AACE).

M14 Yeigh, T., & Lynch, D. (2017). Reforming Initial Teacher Education: A Call for Innovation. *Australian Journal of Teacher Education*, *42*(12), 7.

M15 Yildiz, S.G. & Korpeoglu, S.G. (2016). A Sample WebQuest Applicable in Teaching Topological Concepts. *International Journal of Education in Mathematics, Science and Technology, 4*(2), 133-146.

S1 Akpinar, Y., Ardac, D. & Amuce, N.E. (2015). Computer Versus Computer and Human Support in an Argumentation-based Science Learning Environment. *Journal of Online Learning Research, 1*(2), 137-

161. Waynesville, NC USA: Association for the Advancement of Computing in Education (AACE). Retrieved December 24, 2017

S2 Bakir, N., Devers, C. & Hug, B. (2016). Affordances and Constraints of a Blended Course in a Teacher Professional Development Program. *Journal of Educational Multimedia and Hypermedia, 25*(4), 323-341. Waynesville, NC USA: Association for the Advancement of Computing in Education (AACE). Retrieved December 24, 2017

S3 Doering, A. & Henrickson, J. (2015). Fostering Creativity through Inquiry and Adventure in Informal Learning Environment Design. *Journal of Technology and Teacher Education, 23*(3), 387-410. Waynesville, NC USA: Society for Information Technology & Teacher Education. Retrieved December 24, 2017

S4 Doering, A. & Henrickson, J. (2017). Make it real: Designing authentic online GIS learning for a K12 audience. In J. Dron & S. Mishra (Eds.), *Proceedings of E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education* (pp. 326-337). Vancouver, British Columbia, Canada: Association for the Advancement of Computing in Education (AACE).

S5 Gibbons, S., Yauk, M. & Seo, K.K. (2017). Investigating the Interplay between New Technology and Continuing Professional Education. In J. Johnston (Ed.), *Proceedings of EdMedia 2017* (pp. 1292-1295). Washington, DC: Association for the Advancement of Computing in Education (AACE).

S6 Ibrahim, M. & Callaway, R. (2016). Empowering Pre-service Teachers to Integrate Technology: The Effect of Project-Based Instruction on Students' Self-regulation and Self-Efficacy Perception in Face-to-Face, Hybrid and Online Learning Environment. In *Proceedings of E-Learn: World Conference on E-Learning* (pp. 688-698). Washington, DC, United States: Association for the Advancement of Computing in Education (AACE). Retrieved December 24, 2017

S7 Lin, S., Chan, S.Y., Lin, T.W. & Ni, Y.C. (2017). What drives flow experience in constructing knowledge in social media? In J. Dron & S. Mishra (Eds.), *Proceedings of E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education* (pp. 191-195). Vancouver, British Columbia, Canada: Association for the Advancement of Computing in Education (AACE).

S8 Lou, Y., Hooper, J. & Blanchard, P. (2016). Bald Eagle Adventure: A Game-Based Approach to Promoting Learning through Science Inquiry. In G. Chamblee & L. Langub (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference* (pp. 588-593). Savannah, GA, United States: Association for the Advancement of Computing in Education (AACE). Retrieved December 24, 2017

S9 Meintzer, C., Sutherland, F. & Kennepohl, D. (2017). Evaluation of Student Learning in Remotely Controlled Instrumental Analyses. *The International Review of Research in Open and Distributed Learning, 18*(6), Athabasca University Press.

S10 Norberg, A., Stöckel, B. & Antti, M.L. (2017). Time Shifting and Agile Time Boxes in Course Design. *The International Review of Research in Open and Distributed Learning, 18*(6), Athabasca University Press.

S11 Riaz, M. & Morote, E.S. (2015). A Physics Class Model that Predicts Student Performance. In *Proceedings of E-Learn: World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education* (pp. 897-902). Kona, Hawaii, United States: Association for the Advancement of Computing in Education (AACE). Retrieved December 24, 2017

S12 Schmidt, M. & Fulton, L. (2017). Lessons Learned from Creation of an exemplary STEM Unit for Elementary Pre-Service Teachers: A Case Study. *Journal of Computers in Mathematics and Science Teaching, 36*(2), 189-204. Waynesville, NC USA: Association for the Advancement of Computing in Education (AACE). Retrieved December 24, 2017

S13 Tull, S., Dabner, N. & Ayebi-Arthur, K. (2017). Social media and e-learning in response to seismic events: Resilient practices. *Journal of Open, Flexible, and Distance Learning, 21*(1), 63-76. Distance Education Association of New Zealand.

S14 Wake, D., Dailey, D., Cotabish, A. & Benson, T. (2017). The Effects of Virtual Coaching on Teacher Candidates' Perceptions and Concerns Regarding On-Demand Corrective Feedback. *Journal of Technology and Teacher Education, 25*(3), 327-357. Waynesville, NC USA: Society for Information Technology & Teacher Education.

S15 Zingaro, D., Makos, A., Sharmin, S., Wang, L., Despres-Bedward, A. & Oztok, M. (2017). Student Moderators in Asynchronous Online Discussion: Scaffolding Their Questions. In J. Johnston (Ed.), *Proceedings of EdMedia 2017* (pp. 198-202). Washington, DC: Association for the Advancement of Computing in Education (AACE).

The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 36-41

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

The Effect of Inquiry Based Chemistry Experiments Practıces on Inquiry Skills and Scientific Creativity

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Abstract: Inquiry based research requires individuals to think about a subject, to reason, to conduct indepth research and to discuss the results. Inquiry based research lead the individuals to explore knowledge, investigation, and discovering facts. Permanent learning in science is thought to occur through inquiry, research and exploration. For this reason, in disciplines such as chemistry learning should be conducted by questioning, researching and exploring, that is, inquiry-based research. The purpose of this research is to investigate the effect of inquiry based chemistry experiment practices on the inquiry skills and scientific creativity of prospective teachers. The sampling consisted of prospective chemistry teachers studying at Hacettepe University. In the research, inquiry skills scale and scientific creativity test were used as data collection tools. As a result of the research, it has been determined that inquiry based chemistry experiment practices are an effective approach in order to improve inquiry skills and scientific creativity of teacher candidates. The research findings also reveal that the inquiry-based chemistry experiment practices allow the chemistry to be more understandable, given the opportunity to practice the theoretical knowledge and makes chemistry experiments fun.

Keywords: Inquiry-based practice, Chemistry experiment, Inquiry skills, Scientific creativity

Introduction

Education systems that rely largely on digestion and reproduction of subject content have not produced the desired results. In place of feeding students ready-made knowledge, student-oriented approaches that emphasize how and where to find and use knowledge have become more prominent. One of these approaches is inquiry-based learning (Çalışkan, 2008). The term inquiry refers to searching for knowledge and doing research on phenomena. According to the U.S. National Research Council (NRC), inquiry helps students to comprehend scientific concepts, to realize what they know about science and how they know it, to comprehend the nature of science, to gain the skills necessary to become individual researchers, and to improve their science-related skills and attitudes (Hassard, 2005). Inquiry-based learning activities enable students to increase their knowledge, learn how to think scientifically, and understand how scientists work in natural life (NRC, 2000). This learning approach consists of several steps: doubt or curiosity, defining the problem, generating hypotheses, gathering information, analysis of information and its evaluation, testing the hypotheses, and resuming research in a new way (Obenchain, & Morris, 2003). As a matter of fact, problem solving, constructing hypothesis and experiment and technical innovation require specific form of scientific creativity (Lin, Hu, Adey, & Shen, 2003). Scientific creativity has three dimensions: creative thinking, scientific knowledge and scientific inquiry skills (Park, 2011). According to Demir (2014), scientific creative thinking ability can be defined as “thinking ability that brings together interdisciplinary areas of science, technology and art (aesthetic) and provides individuals’ unique solution ideas of a challenging problem from these areas’ points of views”. As it can be seen from this definition, scientific creativity brings together both the uniqueness of the discipline and different disciplines’ aesthetic aspects. It is considered as a multidimensional and sophisticated field (Demir, 2014). The emphasis here is on the inquiry skills and scientific creativity. The purpose of this research is to investigate the effect of inquiry-based chemistry experiments on the inquiry skills and scientific creativity of prospective teachers.

Method

In the study, a single group pretest-posttest research design was used. The research was carried out in the general chemistry laboratory course. Within the scope of the course, chemistry experiments with investigative research focused on teacher candidates have been carried out.

Sampling

The study group of the study is consists of 17 prospective chemistry teachers' who are studying at Hacettepe University, Faculty of Education. The study was carried out in the General Chemistry Laboratory course during the spring semester of 2017-2018 academic year.

Data Collection Tools

In the research, inquiry skills scale and scientific creativity test were used as data collection tools.

Inquiry Skills Scale

The scale was developed by Aldan Karademir and Saracaloglu (2013). The scale consists of 14 statements in a 5-point Likert Type. Scale consists of information acquisition, information control and self-confidence as named three sub-dimensions. The Cronbach Alpha reliability coefficicent of the whole scale 0.82 and .76, .66, .82 for the sub-dimensions, respectively.

Scientific Creativity Test

The Turkish version of the scale developed by Hu and Adey (2002) was done by Deniş Çelikler and Balım (2012). Scale The scale consists of 7 items aiming to measure the characteristics of students such as extraordinary use, problem finding, product development, scientific imagination, problem solving, scientific experimentation and product design. The Cronbach Alpha reliability coefficient of the scale is 0.86.

Data Analysis

Analysis of the data obtained from the study was carried out using the SPSS 15 packet program. Descriptive statistics were performed primarily when analysis of data from scales was performed. Thus, the inquiry skill levels of the sample group were determined. The research inquiry skills and scientific creativity level change were examined by the Wilcoxon Signed Ranks Test.

Experimental Processing Steps

1. Inquiry: This step is usually intended to create a problem in your mind and to present a solution proposal. For this purpose, open-ended questions can be exploited from the results of observations of any researcher, from astonishing events related to the subject in the process of problem formulation.

2. Disclosure of existing knowledge: In this step, it is aimed to find possible solutions of the research based on existing knowledge.

3. Estimation: It is aimed to express students' proposals starting with "I think" by their reasons. The students are predicting the problem starting with the question mark.

4. Planning and implementing the application: In this step, it is aimed that the students plan and implement the plan to solve the research problem given to them. In this study, students follow the guideline given in order to solve the research question.

5. Interpretation and presentation of results: At this stage of the students return; they record and analyze their observations during the research process. Students share their findings and new information. Students are expected to analyze the data they obtain about the experiment and to interpret and comment on the solution proposals.


Figure 1. Sample application images

Results and Discussion

Findings Related to Inquiry Skills

Descriptive statistics related to the average of the scales applied within the context of effect of inquiry based chemistry experiment practices on the inquiry skills and scientific creativity of prospective teachers are summarized in Table 1.

Table 1. Descriptive statistics of pre-test data

		X	SD
Scale	Inquiry skills	3.94	.52
Sub-dimensions	Information acquisition	4.18	.49
	Information control	3.92	.64
	Self-confidence	3.54	1.04

When we examine the Table 1, we can say that the level of inquiry skills of prospective teachers is high (X: 3.94). When the sub-scales of the inquiry skills scale are examined, it is noteworthy that the prospective teachers have the highest average in the dimension of information acquisition (X: 4.18).

The difference between pre-test and post-test scores of prospective teachers inquiry skills level was examined by Wilcoxon signed rank test, and the results are seen in Table 2.

Table 2. Wilcoxon signed rank test results of inquiry skills

Inquiry skills		N	X	sd	Z	p
Measurement	Pre-test	17	3.95	.59	-1.117	.264
	Post-test	17	4.10	.48		

When the table was examined, it was seen that there was no statistically significant difference between pre-post test scores of inquiry skills (Z=-1.117, $p>0.05$).

The difference between pre-test and post-test scores of prospective teachers inquiry skills level was examined by Wilcoxon signed rank test, and the results are seen in Table 2.

Table 3. Sub -dimensions analyses of inquiry skills

Inquiry skills		N	X	sd	Z	p
Information acquisition	Pre-test	17	4.18	.49	-.252	.801
	Post-test	17	4.20	.57		
Information control	Pre-test	17	3.92	.64	-2.027	.043*
	Post-test	17	4.29	.49		
Self-confidence	Pre-test	17	3.54	1.04	-.269	.788
	Post-test	17	3.60	1.26		

From the table it has seen that, there was a statistically significant difference between pre-post test scores of information control sub- dimension of inquiry skills scale ($Z = 2.027$; $p < 0.05$).

Findings Related to Scientific Creativity

When the scientific creativity test is evaluated, the originality score is calculated. When scores are calculated, the students who enter the first 5% of all correct answers are given 2 points, the students whose answers between 5% and 10% of all correct answers are given 1 point. Other correct answers have a score of 0.

Descriptive statistics of the prospective teachers' related to scientific creativity test before and after the application are summarized in Table 4.

Table 4. Descriptive statistics of scientific creativity pre-post test

Scientific creativity test	Originality score (Pre-test)	Originality score (Post-test)
Item 1	7	6
Item 2	14	16
Item 3	8	10
Item 4	10	8
Item 5	13	16
Item 6	16	11
Item 7	14	13

The difference between pre-test and post-test scores of prospective teachers scientific creativity test scores was examined by Wilcoxon signed rank test, and the results are seen in Table 5.

Table 5. Wilcoxon signed rank test results of inquiry skills

Scientific creativity		N	X	sd	Z	p
Measurement	Pre-test	17	.66	.17	-2.053	.040*
	Post-test	17	.76	.19		

When the table is examined, it is seen that there is a statistically significant difference between scientific creativity pre-post test scores ($Z = -2.053$, $p<0.05$).

Results and Discussion

In this research, it has been determined that inquiry-based chemistry experiment application is an effective approach to scientific creativity and to the information control dimension of inquiry skills. When the literature is examined, the existence of studies supporting the research result is noteworthy (Bayrak, 2014, Demir, 2014; Kadayıfçı, 2008, Karakaş & Afacan, 2017; Abdi, 2014; Maxwell, Lambeth & Cox, 2015; Şen, Yılmaz & Erdoğan, 2016; Kaya & Yılmaz, 2016; Yıldırım & Türker Altan, 2017; Akcanca, 2017).

Inquiry based teaching is seen as teaching initiatives for students to gain the skills of inquiry, to understand the science and to improve their creativity. In order to draw the curiosity of the students during the inquiry process, it is appropriate to start the course by giving daily life situations. Then students should be asked to make estimates about what to do, and the students are asked to question the lesson. Inquiry-based teaching sparks students' curiosity as well as their scientific understanding by drawing examples from daily life and asking the students to make predictions. It gives students the opportunity to learn by exploring and through student-centered inquiry (Yoon, Kim, Kim, Joung, & Park, 2013). An inquiry-based environment permits students to activate their knowledge and helps them to organize their work so that they can be successful in the inquiry process (Pedaste & Sarapuu, 2012). The success of inquiry-based learning can be explained in terms of students being active participants in researching concepts and developing related skills (Lane, 2007). Students learn science as they obtain the skills needed for scientific inquiry through active learning (Hassard, 2005), applying a student-centered approach that enables them to obtain academic skills and take responsibility for absorbing and strengthening their knowledge. With scientific inquiry applications, students become aware of information acquisition, information control and self-confidence criteria. At the same time, activities such as creating a work plan in the laboratory, setting and testing hypotheses, setting up an experimental process, repeating the experiment for best results, writing a research report and presenting the results give the students the ability to work as scientists (Alkan, 2012).

In addition, inquiry-based environments provide opportunities for students to learn and acquire research skills (Spronken-Smith & Walker 2010), an in-depth understanding of scientific questions (Wu & Wu, 2011), opportunities for open and reflective debate (Khishfe & Khalick, 2002), the need for interdisciplinary study of individuals (Mousoulides, 2013), is thought to be the development of scientific creativity of prospective teachers'. Scientific creativity skills are specific to the field and involve individual's personality, thinking abilities, school surroundings, laboratory approach, different unique activities, appropriate learning processes and dimensions of subject matter knowledge. Subject matter knowledge and laboratory approach are considered as fundamentals for developing scientific creativity skills. It is necessary to prepare rich learning environments by using various learning approaches, methods and techniques with appropriate planning and applications for the development of scientific creativity (Demir, 2014). The inquiry-based chemistry laboratory environment contributed to the development of scientific creativity of prospective teachers. The results of this study that scientific creativity skills can develop with experiential applications such as inquiry based experiments are supported by other results findings (Demir, & Şahin, 2013; Demir, 2014). Teachers need to develop a special teaching effort for improving creativity in the science classroom, if the development of scientific creativity is one of the major goals of science learning (Kang, Park, & Hong, 2015). All these characteristics of inquiry could have contributed to the results of this study.

References

Abdi, A. (2014). The effect of inquiry-based learning method on students' academic achievement in science course. *Universal Journal of Educational Research*, *2*(1), 37-41.

Akcanca, N. (2017). *Assessment of activities prepared through teaching techniques supporting scientific creativity for pre-school teacher candidates*. Trabzon: Karadeniz Technical University, Institute of Educational Sciences, Unpublished Doctoral Thesis.

Alkan, F. (2012). *Effect of self-directed learning on the students' success, learning readiness, attitudes towards laboratory skills and anxiety in chemistry laboratory.* Ankara: Hacettepe University, Institute of Science, Unpublished Doctoral Thesis.

Bayrak, Ç. (2014). *The effects of using the expanding (Cort 1) thinking program in the unit " electricity in our lives" in primary education 7th grade lesson, science and technology, to students' academic achievement, scientific creativity and tendency of critical thinking*. Aydın: Adnan Menderes University, Institute of Science, Unpublished Master of Science Thesis.

Çalışkan, H. (2008). *The effect of inquiry-based learning approaches in 7th grade social studies course in primary school on attitude towards course, academic achievement and the degrees of retention*. Ankara: Gazi University, Institute of Educational Sciences, Unpublished Doctoral Thesis.

Demir, S. (2014). *The effect of scientific argumentation and inquiry based laboratory program on prospective science teachers' scientific creativity.* İstanbul: Marmara University, Institute of Educational Sciences, Unpublished Doctoral Thesis.

Demir, S., & Şahin, F. (2013). Assessment of prospective science teachers' metacognition and creativity perceptions and scientific toys in terms of scientific creativity. *Procedia-Social and Behavioral Sciences, 152*, 686-691.

Deniş Çeliker, H., & Balım, A. (2012). Adaptation of scientific creativity test to Turkish and its assessment criterias. *Uşak University Journal of Social Science. 5*(2), 1-21.

Hassard, J. (2005). *The Art of Teaching Science. Inquiry and Innovation in Middle School and High School.*

New York. Oxford University Press.

Hu, W., & Adey, P. (2002). A scientific creativity test for secondary school students. *International Journal of Science Education, 24*(4), 389-403.

Kadayıfçı, H. (2008). *The effect of an instructional model based on creative thinking on students' conceptual understanding of separation of matter subject and their scientific creativity*. Gazi University, Institute of Educational Sciences, Unpublished Doctoral Thesis.

Kang, D., Park, J., & Hong, H. (2015). Changes in the number of ideas depending on time when conducting scientific creativity activities. *Journal of Baltic Science Education, Journal of Baltic Science Education, 14*(4), 448-459.

Karademir, Ç., & Saracaloğlu, A.S. (2013). The development of inquiry skills scale: reliability and validity study. *Asian Journal of Instruction, 1*(2), 56-65.

Karakaş, T., & Afacan, Ö. (2017). Scientific creativity of preschool teacher candidates. *International Journal of Education Science and Technology, 3*(3), 88-102.

Kaya, G., & Yılmaz, S. (2016). The impact of open inquiry based learning on students' achievement and development of science process skills. *Hacettepe University Journal of Education. 31*(2), 300-318.

Khishfe, R., & Abd-El-Khalick, F. (2002). Influence of explicit and reflective versus implicit inquiry-oriented instruction on sixth graders' views of nature of science. *Journal of Research in Science Teaching*, *39*, 551–578.

Lane, J. (2007). *Inquiry-Based Learning*. www.schreyerinstitue.psu.edu/pdf/IBL.pdf Accessed July 15, 2015.

Lin, C., Hu, W., Adey, P., & Shen, J. (2003). The influence of case on scientific creativity. *Research in Science Education, 33*, 143-162.

Maxwell, D.O., Lambeth, D.T., & Cox, J.T. (2015). Effects of using inquiry-based learning on science achievement for fifth-grade students. *Asia-Pacific Forum on Science Learning and Teaching*, *16*(1), 1-31.

National Research Council. Inquiry and the National Science Education Standards: A Guide for Teaching and Learning. Washington, DC: The National Academies Press, 2000. http://www.nap.edu/catalog.php?record_id=9596 Accessed May 06 2015.

Mousoulides, N.G. (2013). Facilitating parental engagement in school mathematics and science through inquiry-based learning: an examination of teachers' and parents' beliefs. *ZDM the International Journal on Mathematics Education*, *45*(6), 863–874.

Obenchain, K.M., & Morris, R. V. (2003). *50 Social Studies Strategies for K-8 Classrooms.* New Jersey: Merrill Prentice Hall.

Park, J. (2011). Scientific creativity in science education. *Journal of Baltic Science Education, 10*(3), 144-145.

Pedaste, M., & Sarapuu, T. (2012). Design principles for support in developing students' transformative inquiry skills in web-based learning environments. *Interactive Learning Environments*, iFirst article, 1–17, DOI:10.1080/10494820.2011.654346.

Spronken-Smith, R., & Walker, R. (2010). Can inquiry-based learning strengthen the links between teaching and disciplinary research? *Studies in Higher Education*, *35*(6), 723–740.

Şen, Ş., Yılmaz, A., & Erdoğan, I.Ü. (2016). Prospective teachers' views of inquiry-based laboratory activities. *Elementary Education Online, 15*(2), 443-468.

Wu, H.K., & Wu, C.L. (2011). Exploring the development of fifth graders' practical epistemologies and explanation skills in inquiry-based learning classrooms. *Research in Science Education*. *41*(3), 319–340.

Yıldırım, M., & Türker Altan, S. (2017). Effect of inquiry-based learning approach on primary school pupils' science process skills. *Mustafa Kemal University Journal of Graduate School of Social Sciences. 14*(38), 71-89.

Yoon, H.Y., Kim, M., Kim, B.S., Joung, Y.J., & Park, Y.S. (2013). Pre-service teachers' views of inquiry teaching and their responses to teacher educators' feedback on teaching practice. *Eurasia Journal of Mathematics, Science & Technology Education*, *9*(4), 347–359. DOI: 10.12973/eurasia.2013.944a.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 42-47

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Exploring the Sources of Turkish High School Students Chemistry Laboratory Self-Efficacy Beliefs and Motivations

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Abstract: Self-efficacy is a belief of individuals about their abilities to successfully complete an action. Self-efficacy is defined as the judgments of individuals about themselves on how successful they will be in dealing with difficult situations they may encounter. Self-efficacy beliefs are related to individual judgments about how well the necessary actions can be performed to handle possible situations. These beliefs affect the choice of activities an individual wants to do, the level of the efforts and the performance. Learners with strong self-efficacy beliefs aim at new tasks, show stability in these tasks and achieve ultimate success. This kind of learners' trust in their abilities when they confront with problems and motivate themselves. Motivation is necessary for individuals to act as cognitively. Therefore, it is very important for teachers knowing in advance of their students' motivation degree and self-efficacy beliefs. In this research it is aimed that the analysis of the relation between self-efficacy beliefs and motivation variables which are highly effective on learning. For numerical analysis we studied 652 high school students in Turkey. The data is collected with chemistry laboratory self-efficacy beliefs scale and chemistry motivation scale. The correlation between the variables are examined using Structural Equation Modeling (SEM). With this study we conclude that there is a positive and significant correlation between chemistry laboratory self-efficacy beliefs and chemistry motivation. This result can be interpreted that the person with high chemistry laboratory self-efficacy has high chemistry motivation.

Keywords: Structural equation modeling, Multivariate analysis

Introduction

Self-efficacy is described as the beliefs of individuals about their abilities to successfully complete an action. It is a part of social cognitive theory. Self-efficacy implies that individuals generally believe in doing actions, which they can successfully complete and they do not try the things that they think they will not achieve (Bandura, 1994). Self-efficacy beliefs of an individual determine his or her feelings, thoughts, behaviors and motivation strategies. According to Bandura, self-efficacy is highly important for the emergence of individuals' behaviors and the formation of new behaviors. People with strong self-efficacy beliefs can even complete difficult tasks easily. These people see challenges to be mastered, rather than threats to be avoided (Bandura, 1994). It is stated that people with a strong sense of self-efficacy maintain strong efforts to achieve the goals and they are persistent and patient (Aşkar & Umay, 2001). It is possible to remark that self-efficacy is related to the situations such as previous experiences, indirect experiences and positive feedbacks (Yıldırım & İlhan, 2010). Learners with strong self-efficacy beliefs aim at new tasks, show stability in these tasks and achieve ultimate success (Britner, 2008; Zeldin & Pajares, 2000). Self-efficacy beliefs are multidimensional and associated with various areas. For example, self-efficacy beliefs with achievement, attitude, motivation or anxiety.

Motivation has a structure which comprises; internal forces, permanent traits, reactionary behaviour against stimuli, faith and influences. Motivation contains belief, internal forces, and reactive behavior against stimuli. Motivation is necessary for individuals to act as cognitively. Therefore it is very important for teachers knowing in advance of their students' motivation degree. If the teachers know the reason of their students' low motivation or self-efficacy beliefs to lessons, they can improve them of their students.

This study is important in terms of examining cause-effect relationship between chemistry laboratory self-efficacy beliefs and chemistry motivation. The aim of this study is that determine the relationship between chemistry laboratory self-efficacy beliefs and chemistry motivation with structural equation modelling. This research will contribute to the determination of the relationship between self-efficacy beliefs and motivation which are the affective variables in learning and in the view of this result it helps to the restructuring of learning environments that supply student's emotional needs.

Method

In this study relational screening models is used. These models are studies in which relationships between two or more variables are described and analyzed in depth (Karakaya, 2011). For this purpose, structural equation model is used to determine the relationship between chemistry motivation and chemistry lab concerns. SEM includes specific multivariate procedures such as factor analysis, correlation analysis and discriminant analysis and is very useful for statistical analysis. In the correlation analysis, only the interchanges of variables are examined. In this study latent variables are used with SEM. SEM allows for the simultaneous analysis of the direct and indirect effects between observable and non-observable variables and allows linear relationships between variables to be computed correctly (Bayram, 2011; Seçer, 2015).

Sampling

The sample group of the study consists of 652 high school students in Turkey. 55.5% of the students were female, 44.5% were male.

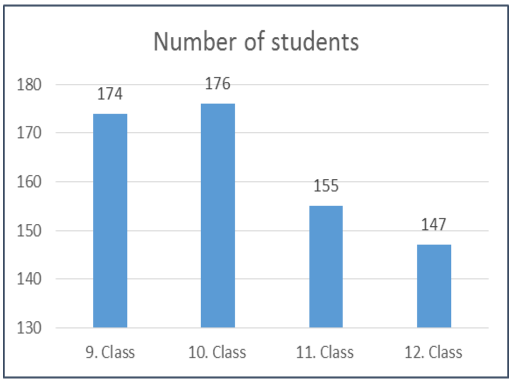

Figure 1. Distribution of sample groups by classes

Data Collection Tools

Chemistry Laboratory Self-Efficacy Beliefs Scale

The self-efficacy beliefs of high school students' towards chemistry laboratory were determined by the "Chemistry Laboratory Self-Efficacy Beliefs Scale" developed by Alkan (2016). The scale consisted of 14 statements in a 5-point Likert Type. The scale had two sub-dimensions named psychomotor self-efficacy and cognitive self-efficacy. The Cronbach Alpha reliability coefficicent of the whole scale 0.885. The Cronbach Alpha reliability coefficient of the psychomotor self-efficacy beliefs sub-dimension was 0.82 and cognitive self-efficacy beliefs sub-dimension was 0.82. The Cronbach's alpha reliability coefficient obtained from sample data's is 0.88.

Chemistry Motivation Scale

Chemistry motivation scale were developed by Glynn, Brickman, Armstrong and Taasoobshirazi (2011) and adapted to the Turkish by Tosun (2013). The motivation scale consisted of 19 statements in a 5-point Likert Type. Scale consists of career motivation, self-efficacy, grade motivation, self-determination, instrinsic motivation as named five sub-dimensions. The Cronbach Alpha reliability coefficicent of the whole scale 0.84. The Cronbach's alpha reliability coefficient obtained from sample data's is 0.89.

Data Analysis

In the analysis SPSS 15 and LISREL 8.7 programmes are used. Descriptive statistics and correlations were calculated for the variables of chemistry laboratory self-efficacy beliefs and chemistry motivation. SEM is used to establish the model of relationships between these variables. Correlation analysis is used to determine the level of relationship between variables, whereas regression analysis is used for functional explanations. However, if the correlation coefficient calculated between two variables is influenced by another variable or variables, or if the causal relation between two variables depends on the effect of a third variable, the correlation coefficient is insufficient to explain this relationship. In this situation SEM should be used. It is also known as a statistical analysis that examines the relations between standardized variables. It contains creation of path diagrams which show relations between variables and detail comments on direct and indirect effects of correlation coefficient. The difference between path analysis and other analysis is that it can analyze direct and indirect effects among variables. The simple model of the path analysis is the model with only direct effects among the variables, and this is similar to the multiple regression analysis. The direct effect means that when the other independent variables are constant, correlation between the one independent variable and dependent variable.

Results and Discussion

Descriptive statistics related to the average of the scales applied within the context of the relationship between chemistry laboratory self-efficacy beliefs and chemistry motivation of high school students are summarized in Table 1.

Table 1. Descriptive statistics of the scales

Scales	M	SD
Chemistry Laboratory Self-Efficacy Beliefs	3.29	.62
Psychomotor self-efficacy beliefs (Y1)	3.24	.75
Cognitive self-efficacy beliefs (Y2)	3.34	.62
Chemistry Motivation	3.36	.62
Career motivation (M1)	3.28	.78
Self-efficacy (M2)	3.42	.75
Grade motivation (M3)	3.53	.75
Self-determination (M4)	3.26	.77
Instrinsic motivation (M5)	3.14	.88

When we examine the Table1, we can say that the level of chemistry laboratory self-efficacy beliefs of students is high and chemistry motivation is medium level. When the sub-scales of the chemistry laboratory self-efficacy beliefs scale are examined, it is noteworthy that the students have the highest average in the dimension of cognitive self-efficacy beliefs. In the sub-scales of the chemistry motivation scale, students have highly motivation about grade motivation and followed by the self-efficacy sub-dimension.

Table 2. Correlations of the Sub-dimensions

		M1	M2	M3	M4	M5	Y1	Y2
M1	Pearson Correlation	1	,624**	,482**	,589**	,568**	,083*	,104**
	Sig. (2-tailed)		,000	,000	,000	,000	,033	,008
	N	652	652	652	652	652	652	652
M2	Pearson Correlation	,624**	1	,574**	,544**	,525**	,137**	,099*
	Sig. (2-tailed)	,000		,000	,000	,000	,000	,012
	N	652	652	652	652	652	652	652
M3	Pearson Correlation	,482**	,574**	1	,493**	,509**	,145**	,149**
	Sig. (2-tailed)	,000	,000		,000	,000	,000	,000
	N	652	652	652	652	652	652	652
M4	Pearson Correlation	,589**	,544**	,493**	1	,489**	,109**	,129**
	Sig. (2-tailed)	,000	,000	,000		,000	,005	,001
	N	652	652	652	652	652	652	652
M5	Pearson Correlation	,568**	,525**	,509**	,489**	1	,046	,039
	Sig. (2-tailed)	,000	,000	,000	,000		,237	,315
	N	652	652	652	652	652	652	652
Y1	Pearson Correlation	,083*	,137**	,145**	,109**	,046	1	,687**
	Sig. (2-tailed)	,033	,000	,000	,005	,237		,000
	N	652	652	652	652	652	652	652
Y2	Pearson Correlation	,104**	,099*	,149**	,129**	,039	,687**	1
	Sig. (2-tailed)	,008	,012	,000	,001	,315	,000	
	N	652	652	652	652	652	652	652

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

In Table2, we give the correlations between all sub-scales using correlation analysis. From this table we can say that all correlations are significant and there is a positive correction between chemistry laboratory self-efficacy beliefs and chemistry motivation.

Findings regarding the Structural Equation Modeling;

To examine the relationship between the latent variables chemistry laboratory self-efficacy beliefs with chemistry motivation we have used Structural Equation Modeling. In this analysis our null hypothesis is;

H_0 : There is no significant correlation between the chemistry laboratory self-efficacy beliefs with chemistry motivation.

H_s : There is significant correlation between the chemistry laboratory self-efficacy beliefs with chemistry motivation.

The model which obtained from SEM is given in Figure1.

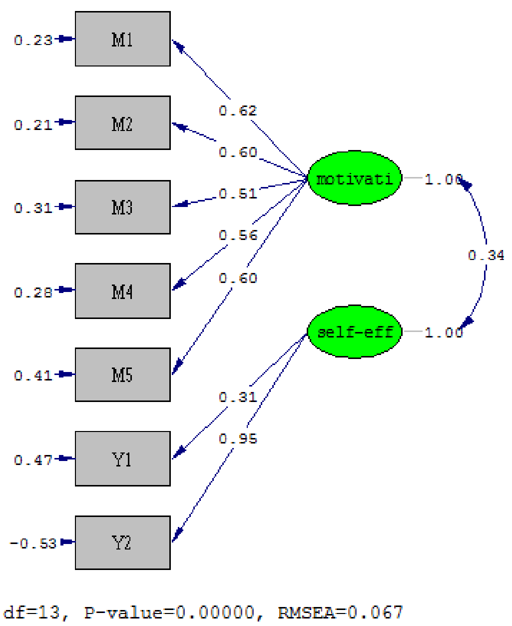

Figure 2. The SEM model for chemistry laboratory self-efficacy beliefs with chemistry motivation

In Figure 2, we can see that there is a positive and significant correlation between the chemistry laboratory self-efficacy beliefs and chemistry motivation. The standardized path coefficient from chemistry laboratory self-efficacy beliefs and chemistry motivation is found as 0.34.

Table 3. Results of SEM for chemistry laboratory self-efficacy beliefs with chemistry motivation

Variables	Path Coefficient	T Values	R^2
M1	0.62	22.93	0.63
M2	0.60	22.90	0.63
M3	0.51	18.50	0.46
M4	0.56	20.19	0.52
M5	0.60	18.79	0.47
Y1	0.31	6.79	0.17
Y2	0.62	22.93	0.63

The path coefficients which are obtained with path diagram are given in Table3 and we can say that all are significant. The goodness of fit of the model shown in Figure1 is examied with the criterias given in Table 4. We can say that our model is significant based on all criterias. (For details see: Dursun and Kocagöz, 2010).

Table 4. Criteria of SEM

	Well Fitness	Acceptable Fitness	Result
RMSEA	$0<RMSEA<0.05$	$0.05<RMSEA<0.10$	0.067 Acceptable
NFI	$0.95 \leq NFI \leq 1$	$0.90 \leq NFI \leq 0.95$	0.98 Well
NNFI	$0.97 \leq NNFI \leq 1$	$0.95 \leq NNFI \leq 0.97$	0.98 Well
CFI	$0.97 \leq CFI \leq 1$	$0.95 \leq CFI \leq 0.97$	0.99 Well
GFI	$0.95 \leq GFI \leq 1$	$0.90 \leq GFI \leq 0.95$	0.98 Well
AGFI	$0.90 \leq AGFI \leq 1$	$0.85 \leq AGFI \leq 0.90$	0.95 Well
χ^2	51.18 (sd=13 p=0.00)		

According to above Table there is significant correlation between the chemistry laboratory self-efficacy beliefs with chemistry motivation.

Conclusion

In this study we have examined the relationship between chemistry laboratory self-efficacy beliefs and chemistry motivation using different statistical tools. We try to take into account the direct and indirect correlations between sub-scales of chemistry laboratory self-efficacy beliefs and chemistry motivation. We try to model the sub-scales with SEM. We obtain a statistically significant model. We can conclude that there is a significant positive relationship between chemistry laboratory self-efficacy beliefs and chemistry motivation.

The present study has several inferences for high school students. It is important to improve students' motivation towards chemistry and to increase self-efficacy beliefs towards laboratory in learning environments. These expectations can be realized when students' have a chance to observe their teachers who use the science and chemistry effectively (i.e., experimenting in class) or when students use chemistry experiments in their own instruction during the projects. Teachers should help students to see the benefits of chemistry through experiments which are basic and not dangerous. Through can be augmentable the self-efficacy beliefs of high school students towards laboratory and so augmentable the motivation towards chemistry. For example, chemistry teachers should use daily life applications and daily chemistry experiments in their lessons to make them more conceptual, which will allow students' to see how chemistry is helpful and useful in understanding science concepts. Furthermore, teachers should gain more experience in using chemistry laboratory; this could be succeed by presenting more laboratory applications include incorporating experiments use in teaching chemistry. Teachers' laboratory practices not only enhances students' motivations, but also reduces their laboratory self-efficacy beliefs. Grounded on our feedback of students' statements and wishes, laboratory applications can be impressive in enhancing chemistry motivations and chemistry laboratory self-efficacy beliefs.

References

Alkan, F. (2016). Development of chemistry laboratory self-efficacy beliefs scale. *Journal of Baltic Science Education, 15*(3), 350-359.

Aşkar, P., & Umay, A. (2001). Perceived computer self-efficacy of the students in the elementary mathematics teaching programme. *Hacettepe University Journal of Education*, *21*, 1-8.

Bandura, A. (1994). *Self-efficacy*. V.S. Ramachaudran (Ed.). Encyclopedia of human behavior. New York: Academic Press.

Bayram, N. (2011). *Introduction to structural equation modeling*. Ankara: Ezgi Press.

Britner, S.L. (2008). Motivation in high school science students: A comparison of gender differences in life, physical, and earth science classes. *Journal of Research in Science Teaching*, *45*(8), 955-970.

Dursun, Y. & Kocagöz, E. (2010). Structural equation modeling and regression: A comparative analysis. *Erciyes University Journal of Faculty of Economics and Administrative Sciences*, *35*, 1-17.

Karakaya, İ. (2011). *Scientific research methods*. Ankara: Anı Press.

Glynn, S.M., Brickman, P., Armstrong, N., & Taasoobshirazi, G. (2011). Science motivation questionnaire II: Validation with science majors and nonscience majors. *Journal of Research in Science Teaching, 48*(10), 1159-1176.

Seçer, İ. (2015). *Practical data analysis with SPSS and LISREL: Analysis and Reporting.* Ankara: Anı Press.

Tosun, C. (2013). Adaptation of chemistry motivation questionnaire-ii to Turkish: a validity and reliability study. *Erzincan University Journal of Education Faculty, 15*(1), 173-202.

Yıldırım, F., & İlhan, İ.O. (2010). The validity and reliability of the general self-efficacy scale-Turkish form. *Turkish Journal of Psychiatry, 21* (4), 301-308.

Zeldin, A.L., & Pajares, F. (2000). Against the odds: Self-efficacy beliefs of women in mathematical, scientific, and technological careers. *American Educational Research Journal*, *37*, 215-246.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 48-51

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Effects of Writing to Learn Activities in Hands-on and Virtual Laboratory Environments

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Abstract: The Science Writing Heuristic (SWH) approach mainly developed by Hand and Keys (1999). The approach involves two sets for both teachers and students to be mindfully active in an inquiry based laboratory environments. The set for students provides scaffolds in written form in order to help metacognition about their lab experiments (Hohenshell & Hand, 2006) and the set for teachers enable them to design inquiry based science laboratories. In the current study, it was investigated that the effects of SWH approach in hands-on and virtual lab environments on pre-service science teachers' laboratory skills and science achievements. Quasi-experimental research design was used in the current study. Participants of the study were 52 pre-service science teachers. They were assigned into two groups, one of which them used hands-on laboratory environment, coded as control group. The other group used virtual laboratory environment called as experimental group. The attitude scale towards laboratory skills and the achievement test were used in the study. Overall results indicated that SWH based lab environments are equally effective on students' attitudes and achievements.

Keywords: Science writing heuristic, hands-on lab, Virtual lab, Attitude, Achievement

Introduction

One of the main goals of science education is to educate individuals as scientifically literate. Most of the reforms in science teaching curriculum, including Turkey, are made to encourage students to develop their science literacy (Kingir, Geban & Gunel, 2012). In order to reach this goal, constructivism is one of the efficient approaches. It is defined as constructing knowledge through mindfully active processes (Posner, Strike, Hewson & Gertzog, 1982). In this approach, students are active learners rather than passive recipients.

The Science Writing Heuristic (SWH) approach is also based on constructivism and mainly developed by Hand and Keys (1999). Writing is mode of thinking in SWH based classrooms (Hand, Wallace & Yang, 2004; Kingir, Geban & Gunel, 2012) and it encourages students for construction of meaning for verbal symbols, which then help them to develop scientific knowledge and scientific literacy (Keys, Hand, Prain & Collins, 1999; Hand, Wallace & Yang, 2004). The approach involves two sets for both teachers and students to be mindfully active in an inquiry based laboratory environments. The set for teachers is given Table 1 (Hand & Keys, 1999). It involves activities to prompt students to think about concepts and enables teachers to design inquiry based science laboratories. The set for students (Table 2) provides scaffolds in written form in order to help metacognition about their lab experiments (Hand & Keys, 1999; Hohenshell & Hand, 2006).

Table 1. The set for teachers in SWH approach (Hand & Keys, 1999, p. 28)

1. Exploration of pre-instruction understanding through individual or group concept mapping.
2. Pre-laboratory activities, including informal writing, making observations, brainstorming, and posing questions.
3. Participation in laboratory activity.
4. Negotiation phase I – writing personal meanings for laboratory activity.
5. Negotiation phase II – sharing and comparing data interpretations in small groups.
6. Negotiation phase III – comparing science ideas to textbooks or other printed resources
7. Negotiation phase IV – individual reflection and writing.
8. Exploration of post-instruction understanding through concept mapping.

In SWH based learning environments, students as a group, firstly, posing testable question(s). Then, they design investigation(s) to find answer their question(s). They gather data, analyze them and inferring. After that they share their findings with other groups through discussions. Finally, the new knowledge is integrated with the existed one the reflection. The process can be summarizable as students construct knowledge by making claims and supporting these claims with evidence based on their experimentation (Kingir, Geban & Gunel, 2012, p. 429). Teacher's role is scaffolding students through these processes.

Table 2. The set for students in SWH approach (Hand & Keys, 1999, p. 28)

1. Beginning ideas – What are my questions?
2. Tests – What did I do?
3. Observations – What did I see?
4. Claims – What can I claim?
5. Evidence – How do I know? Why am I making these claims?
6. Reading – How do my ideas compare with the other ideas?
7. Reflection – How have my ideas changed?

Laboratories are crucial learning environments in science education because it provides learning by inquiry (Minner, Levy & Century, 2010). Although hands-on labs are common at schools (Kapici & Akcay, 2018), virtual labs enter the classrooms with respect to developments in educational technology. Each type of lab environments has its own affordances. There are a lot of studies about the effects of virtual labs on students' domain knowledge (e.g. McGrath, Wegener, Mclntyre, Savage & Williamson, 2010; Zacharia & Constantinou, 2008) and most of these studies concluded that there is no certain boundary between these two lab environments with regard to students' achievement (e.g. Hannel & Cuevas, 2018).

In the current study, it was investigated that the effects of SWH approach in hands-on and virtual lab environments on pre-service science teachers' attitudes toward laboratory skills and achievements. Based on this, two research questions were determined as following:

1. Is there any significant difference between students who used SWH based hands-on lab environment and SWH based virtual lab environment with regard to their achievement?

2. Is there any significant difference between students who used SWH based hands-on lab environment and SWH based virtual lab environment with regard to their attitudes toward laboratory skills?

Method

The study is based on quantitative research methodology and quasi-experimental research design was used in the current study. Participants of the study were 52 pre-service science teachers. They were assigned into two groups, one of which them used hands-on laboratory environment, coded as control group. The other group used virtual laboratory environment called as experimental group. Whereas there were 28 students in the control group, 24 students were in the experimental group.

Two different instruments were used in the study. First of them was attitude scale towards laboratory skills developed by Alkan and Erdem (2012). The scale involves 25 items under four sub-dimensions. These sub-dimensions are recognizing the materials and chemicals in the laboratory, considering feedback, communication in the laboratory and feeling ready him/herself. Cronbach's alpha coefficient for the whole scale was found as 0.91 by Alkan and Erdem (2012). The other instrument was achievement test. The questions in the test were taken from national university entrance exams. There were totally 12 questions in the test. The data gathered from the attitude scale and achievement test analyzed by independent sample *t* test.

In hands-on lab environment, students used paper form of the template and for the virtual lab environment, students used online form it. Students designed and implemented experiments about four topics, which are acid-base, solutions, electricity and buoyancy force. Open-ended inquiry was followed. Students determined their own research questions and asserted claims. They designed their experiments with respect to their questions (or hypothesis) and implemented. They reached conclusion based on evidences gathered from experiments. Students wrote the entire steps they followed either in paper form or online form. Whereas students in hands-on lab environment used physical materials in a traditional lab environment, students in the virtual lab environment used online lab platform for their laboratory investigations.

Results and Discussion

The effects of hands-on and virtual lab environments on pre-service science teachers' attitudes toward laboratory skills and achievements were investigated in the study.
The findings based on the attitude scale revealed that there is no significant difference between the groups (see Table 3). This result means that both of the SWH based laboratory environments are equally effective on pre-service science teachers' attitudes toward laboratory skills.

Table 3. Independent sample t test result for the attitude scale

Groups	N	Mean	SD	t	p
Control	28	4.03	.483	.510	.612
Experiment	24	3.97	.478		

Similar way was used to analyze the data gathered from achievement test. The findings showed that there is no significant difference between the groups (see Table 4). This result proves that both of the SWH based laboratory environments are equally effective on pre-service science teachers' achievements.

Table 4. Independent sample t test result for the achievement test

Groups	N	Mean	SD	t	p
Control	28	7.66	1.48	1.035	.305
Experiment	24	8.24	4.17		

Overall results indicated that SWH based lab environments are equally effective on students' attitudes and achievements. It can also be said that SWH approach can be effective in virtual lab environments as much as in hands-on lab environments.

Such kind of studies can be extended with middle school and high school students. Application of SWH approach into virtual lab environments can be investigated.

References

Alkan, F., & Erdem, E. (2012). A study on developing attitude scale towards laboratory skills. *Hacettepe University Journal of Education, 1*, 22-31.

Hand, B., & Keys, C. W. (1999). Inquiry investigation: A new approach to laboratory reports. *The Science Teacher, 66*, 27-29.

Hand, B., Wallace, C. W., & Yang, E.-M. (2004). Using a science writing heuristic to enhance learning outcomes from laboratory activities in seventh-grade science: Quantitative and qualitative aspects. *International Journal of Science Education, 26*, 131-149.

Hannel, S. L., & Cuevas, J. (2018). A study on science achievement and motivation using computer-based simulations compared to traditional hands-on manipulation. *Georgia Educational Researcher, 15*, 39-55.

Hohenshell, M. L., & Hand, B. (2006). Writing-to-learn strategies in secondary school cell biology: A mixed method study. *International Journal of Science Education, 28*, 261-289.

Kapici, H. O., & Akcay, H. (2018). Choices of pre-service science teachers laboratory environments: Hands-on or hands-off? *World Journal on Educational Technology: Current Issues, 10*, 41-51.

Keys, C. W., Hand, B., Prain, V., & Collins, S. (1999). Using the science writing heuristic as a tool for learning from laboratory investigations in secondary science. *Journal of Research in Science Teaching, 37*, 676-690.

Kingir, S., Geban, O. & Gunel, M. (2012). How does the science writing heuristic affect students' performances of different academic achievement levels? A case for high school chemistry. *Chemistry Education Research and Practice, 13*, 428-436.

McGrath, D., Wegener, M., Mclntyre, T. J., Savage, C., & Williamson, M. (2010). Student experience of virtual reality: A case study in learning special relativity. *American Journal of Physics, 78*, 862-868.

Minner, D. D., Levy, A. J., & Century, J. (2010). Inquiry-based science instruction-What is it and does it matter? Results from a research synthesis years 1984 to 2002. *Journal of Research in Science Teaching, 47*, 474-496.

Posner, G. J., Strike, K. A., Hewson, P. W., & Gertzog, W. A. (1982). Accommodation of a scientific conception: Toward a theory of conceptual change. *Science Education, 66*, 211-227.

Zacharia, Z. C. & Constantinou, C. P. (2008). Comparing the influence of physical and virtual manipulatives in the context of the physics by inquiry curriculum: The case of undergraduate students' conceptual understanding of heat and temperature. *American Journal of Physics, 76*, 425-430.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 52-58

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Enhancement of School Students' Interest in, and Attitude toward Science by Training Their Teachers on Effective Delivery of Practical Activities

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Abstract: In this paper we report on enhancing students' attitude toward and interest in science by training teachers on Effective Practical Delivery in science. Teachers from 17 schools in Qatar, among them 24 secondary school teachers teaching grade 11, and 11 preparatory school teachers teaching grade 8, were enrolled in two, independent, extended training courses (four hours per week for 16 to 18 weeks) on delivery of practical science lessons. Each course was designed to train teachers on delivering practical activities aligned with science curriculum standards, in a way that allowed teachers to practice each activity during the training before delivery to their students. Teachers would then reflect on their teaching and discuss feedback with their trainers and colleagues in the subsequent training session.Evaluation of the program was based on Trainees' performances, student performance and measurement of students' attitudes toward science before and after training. Results suggest a notable and significant change in the skills, knowledge and confidence of teachers in delivery of practicals in their science classes as reflected by results from tests and observations. This paper will focus on the measurement of secondary school trainees' students' attitude toward science before and after training. Main findings using t-test show:

- Very significant increase in attitude of trainees' students after training ($p < 0.0001$)
- No significant change in control schools' students over the same period (p 0.78 - 0.86)
- Male students show higher attitude & higher self-efficacy than female students toward practical part of science and future science career but no significant difference in attitude toward science in general.

Keywords: Science**,** Practical, Delivery, Curriculum Standards, Training

Introduction

In general, attitudes are defined as a predisposition to respond positively or negatively to things, people, places, or ideas. Attitude contains affective, cognitive, and behavioral components (Simpson & Oliver, 1995) Attitudes toward science refer to whether a person likes or dislikes science, or has "a positive or negative feeling about science" (Koballa & Crawley, 1985, p. 223). Attitudes toward science, by researchers at one time or another, have been used to describe: a) attitudes towards science and scientists; b) attitudes towards school science; c) enjoyment of science learning experiences; d) interests in science and science-related activities; and e) intentions to pursue a career in science or science-related work (Tytler & Osborne, 2012).

Many research studies confirm the positive correlations between students' achievement in science subjects and positive attitudes toward science. Students who have positive attitudes show increased attention to classroom instruction and participate more in science activities (Shrigley et al.1988, Osborne, Simon &Collins 2003).

The focus on student interest and attitudes in the sciences derives from the well-established relationship between these affective variables and pre-college students' learning and achievement (Ainley, Hidi, & Berndorff, 2002;

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Hidi, 1990; Tobias, 1994) particularly in science (e.g., Chang & Cheng, 2008; Glynn et al., 2009, Laukenmann et al., 2003; Weinburgh,1995). Additional studies (e.g., Borget & Gilroy, 1994, Calabrese Barton & Basu, 2007; Lavonen, et al., 2008; Mason & Kahle, 1989) have reported a relationship between such affective factors and decisions to pursue scientific studies, as well as choice of future careers.

Positive attitude is developed through personal support (teachers and family), use of a variety of teaching strategies and innovative learning activities, and student-centered instructional design (Csikszentmihalyi, 1997, Jarvis and Pell 2005). Previous studies have reported a decline in students' attitudes toward science as they approach secondary school (Farenga & Joyce, 1998; Kelly, 1986; Pell & Jarvis, 2001; Yager & McCormack 1989, Said et al. 2016). This decrease is especially pronounced for girls (Greenfield, 1997). Lovelace and Brickman (2013) reviewed several research studies on attitudes and students' motivation which show that "*students' perceptions of courses and attitudes toward learning play a significant role in retention and enrollment. Motivation has a strong direct effect on achievement, and, in some courses, students' attitudes may provide a better predictor of success than quantitative ability" (p.606)*

It is well known that students, as other humans, tend to experience the greatest enjoyment when they are involved in activities that require some investment of skill or effort (Harter 2009) According to Shumow and Schmidt (2014) "*If given the choice many students will opt for an activity that presents a moderate challenge over one that is mindless, because the challenging one is actually more enjoyable. Thus if students experience challenge in science, they may be more likely to choose to become involved in science tasks. Challenging activities are not just enjoyable, they also require that students focus their attention and energy in engaging more deeply in the task at hand. Thus practical activities are the best challenging tasks in learning science"* (p.112).

The fact that science teaching is most commonly associated with a laboratory, which is part of the physical environment, may favor the positive impact of physical environment on students' attitude and achievement. Therefore, researchers mostly report positive correlations between school environment and students' achievement. However, the extent of the impact and its significance is also dependent on other factors and, therefore, results cannot be conclusive.

In previous investigations (Said et. al 2013, 2016), we extensively studied the science teaching practices in Qatar. One finding of these studies was a declining interest in science and declining intentions to pursue or engage with science as they proceed across the grade ladder.

Tytler and Osborne (2012) explained that attitudes towards science is a complex concept that may include one or more of the following concepts embodied:

- the display of favorable attitudes towards science and scientists;
- the display of favorable attitudes towards school science;
- the enjoyment of science learning experiences;
- the development of interests in science and science-related activities;
- the development of an interest in pursuing a career in science or science related work.

In this paper we present results of how practical activities improve interest in, and attitude toward, science of secondary school students whose teachers were trained on effective delivery of these practical activities and how this training has impacted these attributes.

Method and Procedure

Participants

In the first phase (the focus of this paper) the participant teachers and students were as shown below:

- Number of teachers' trainees 24 (12 males and 12 females) – 8 from each science subject: Biology, Chemistry and Physics teaching grade 11.
- Number of control teachers: 27 (14 males and 13 males) selected randomly from various schools
- Number of schools involved – 8 intervention + 2 control
- Number of students impacted: 1800
- Number of training sessions: 19

- Total number of training hours: 80

Characteristics of the Plan

The main features that characterize the plan as implemented were based on the guidelines published by the Council of Chief State School Officers (CCSSO) on successful program development for teachers (Blank and Alas 2009). The authors reviewed extensively, by a meta-analysis study, hundreds of published papers on successful professional development programs for science and math teachers. They selected 74 of those which linked students' learning to their teachers' professional development programs. In another screening process, they selected 16 programs with best learning outcomes. The common features of these 16 programs are:

- content focus,
- active learning by teachers,
- coherence with curriculum/standards,
- collective participation,
- sufficient time (frequency, duration, follow-up).

Recently, Hammond et al. (2017) reviewed 35 methodologically rigorous studies that have demonstrated a positive link between teacher professional development, teaching practices, and student outcomes. Very similar common features were identified. This review indicated, as they stated, "that meaningful professional learning that translates to changes in practice cannot be accomplished in short, one-off workshops (p.15). Our program which started in 2015, has several common features to these characteristics.

The procedure that we implemented is summarized below:

In every training session conducted at the end of the week, teachers were trained on practical activities on a specific topic from the curriculum, selected to be in line with the academic plan provided by MEHE, then they perform the same activities at their schools in the week to follow. In the subsequent training session, teachers reflect and discuss feedback with their trainers and colleagues. Evaluation of the program is based on both teachers' performance and students' attitudes before and after training (Said et al. 2017).

Secondary school teachers' performances were tested by two means: class observation to assess lab delivery skills after the training course compared with a control group. In the last session, the 24 teachers were asked to write a comprehensive test on subject content knowledge, the related activities performed, and on designing lab experiments. Twenty-seven teachers, randomly selected from different schools, served as a control group and were also asked to take the same test.

Students' Attitude toward Science

As mentioned previously, this paper is concerened with the impact of teachers' training in improving students' attitude toward science.

544 students from classes taught by trainee teachers and 224 control students from students taught by teachers from two control schools were surveyed before and after the long training course in order to evaluate any change that could have happened in students' attitude toward, and interest in, science over the period of the training course (October 2015-April 2016).

Results and Discussion

A 5-point Likert score survey that contained 40 items grouped into six subset factors, was administered. The six factors include: Attitude, value of science, self-efficacy, family support, teacher support and attitude toward practical activities.

Figure 1 compares pre and post training interest in and attitude toward science of trainees' students before and after practical.As can be shown from the figure, the mean average of all the six factors increased significantly.

t-test analysis of the six factors using a statistical package for the social sciences, SPSS software, gives the data shown in Table 1. As shown from the table, the two-tailed "p" value is less than 0.0001 for all the six factors.

By conventional criteria, this difference is considered to be extremely statistically significant which is interpreted as a significant positive change reflecting the great impact of teachers' training on students' interests and attitude toward science.

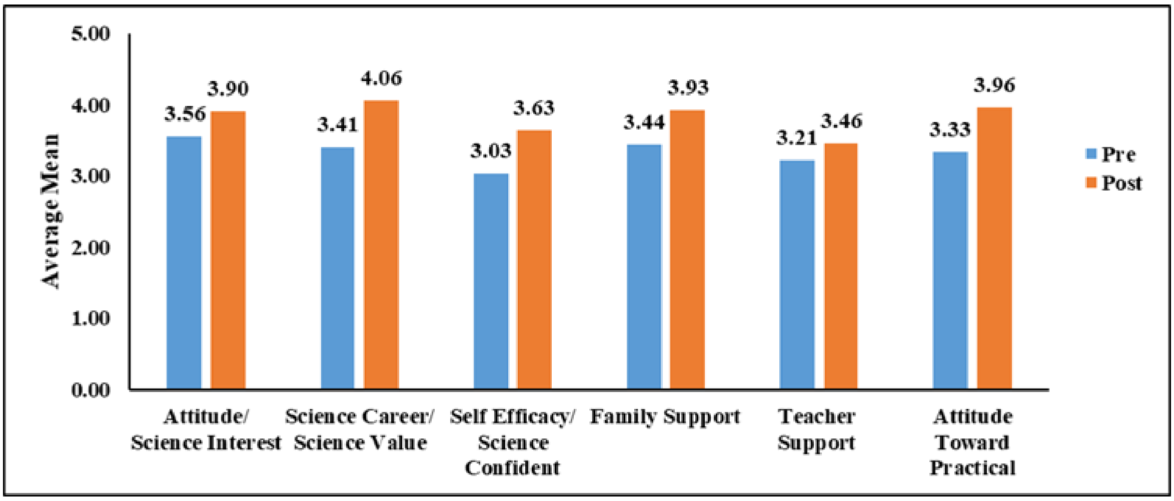

Figure 1. Change in interest and attitude toward science of students after training of their teachers on effective delivery of practical activities in science

Table 1. T-test analysis comparing students' attitude and interest in science before and after their teachers' training

#	Full Description	Short Description	Training	Mean	STD	Test	p	SED
1	Students' Interest in Science (or Students' Science Attitudes)	Attitude	Pre-Training	3.5571	0.67431	8.3893	<0.0001	0.041
			Post-Training	3.9049	0.65008			
2	Students' Beliefs About the Value of Science (Why Science Is Valuable to Me)	Value Of Science	Pre	3.4072	0.52008	17.8050	<0.0001	0.037
			Post	4.0593	0.65044			
3	Students' Beliefs About Their Science Proficiency	Self-Efficacy	Pre	3.0304	0.68776	13.4583	<0.0001	0.045
			Post	3.633	0.74339			
4	Students' Beliefs About Support from Their Families	Family Support	Pre	3.4434	1.13044	7.4024	<0.0001	0.066
			Post	3.9290	0.9556			
5	Students' Beliefs About Support from Their Teachers and School	Teacher Support	Pre	3.214	0.63387	6.3932	<0.0001	0.038
			Post	3.459	0.58931			
6	Items Difficult to Group (and difficult to add scores to each other or other items in a scale)	Attitude Toward Practical	Pre	3.3342	0.76147	13. 1848	<0.0001	0.048

Figure 2 compares change in one specific factor (students' attitude) with two different control schools: one school is classified by the Ministry of Education and High Education among below average performing school in science (control-1) and the other is one among the best schools (control-2). Teachers from control school (2) are among the teachers who participated in the skill test. Four of them performed relatively well in the knowledge content test with the trainee teachers.

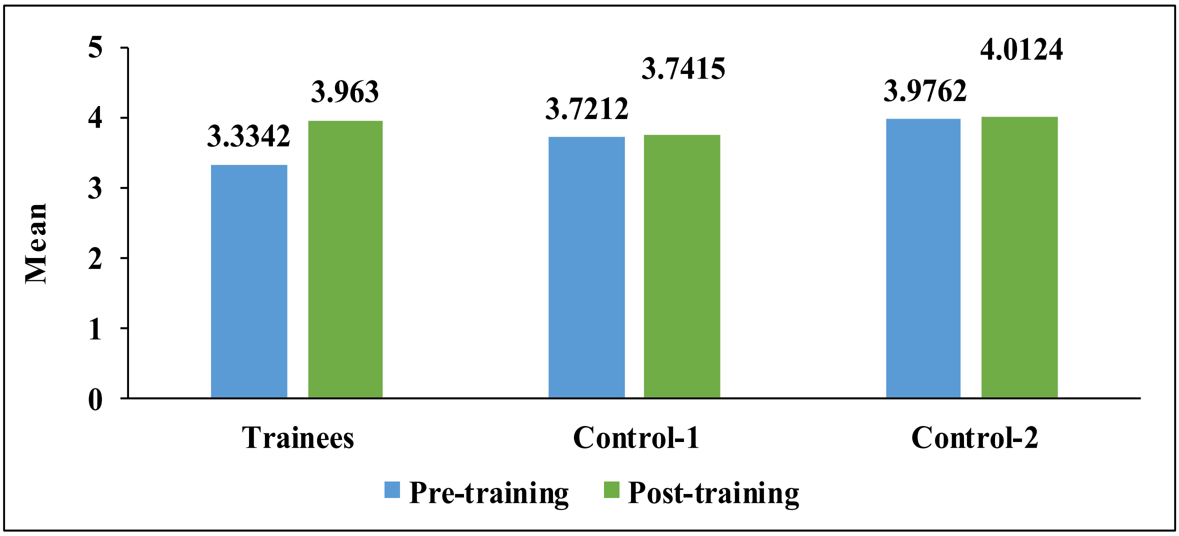

Figure 2. Change in students' attitude toward science-comparison with students' from two control schools

Table 2 summarizes t-test data results comparing change in attitude of students from the 8 trainees' schools and the two control schools. As shown from the table, the two-tailed P values of the control groups 0.8630 and 0.743, by conventional criteria, these differences are considered to be not statistically significant. On the contrary, students' attitudes at the 8 experimental schools have significantly positively changed over the same period of the long training course (P<0.0001). Another equally important factor, also, is the attitude toward practical activities which has been significantly improved which also contributed to the enhanced self-efficacy of students (factor -2 in Table 1). These results reflect the importance of effective delivery of practical training of teachers that help students to improve both understanding of theoretical principles and practical skills when communicating science to their students.

Table 2. T-test analysis of data on impact of training teachers on students' attitude toward science, comparison with students from two control schools

		N	**Mean**	**STD**	**Test**	**Sig.(P)**	**SED**
Trainees	Pre-Training	521	3.5571	0.67431	8.4330	<0.0001	0.041
	Post-Training	511	3.9049	0.65008			
Control-1	Pre-training	124	3.7212	0.9878	0.1727	0.8630	0.118
	Post-training	111	3.7415	0.7892			
Control-2	Pre-training	127	3.9762	0.8890	0.3274	0.7436	0.111
	Post-training	110	4.0124	0.7998			

Gender Difference

T-test analysis, to find out the extent of these variations for each gender before and after training, shows that improvement is more favored in the case of male students in two constructs of attitudes indicated by the higher test values and lower p-values (table-3). This gender–related difference in attitude toward practical science is a common phenomenon associated with a feeling of less confidence of girls than boys about pursuing science and dealing with technological instruments (Brotman & Moore 2008).

Table 3. Pre-and post-training impact of teachers' training on students' attitude toward practical and self-efficacy before and after training – Two Sample t-test

	Male				**Female**			
	Self-efficacy		Attitude toward practical		Self-efficacy		Attitude toward practical	
	Pre-Training	Post-Training	Pre-Training	Post-Training	Pre-Training	Post-Training	Pre-Training	Post-Training
N	255	266	260	256	261	255	264	262
M	3.83	4.14	3.93	4.23	3.60	3.70	3.87	3.98
SD	1.33	1.19	1.25	1.15	1.39	1.28	1.12	1.05
T	2.80		2.66		1.020		1.311	
P	0.0051		0.0080		0.0309		0.01810	

Conclusion

Students' interest in, and attitude toward science, was greatly enhanced by enrollment of their teachers on effective delivery of practical activities through a long training course which is content focused with "hands-on, mind-on" activities in alignment with their curriculum delivery. Statistical analysis indicates significant improvement in students' belief in the value of science, their self-efficacy, their teacher support and their attitude toward practical activities. Male students expressed better attitude toward practical activities and showed more self-efficacy.

Acknowledgements or Notes

This research was made possible by grant # NPRP 8-503-5-065 from the Qatar National Research Fund, QNRF (a member of Qatar Foundation). We are indebted to all teachers and students participated in this project. The statements made herein are solely the responsibility of the author(s).

References

Ainley, M., Hidi, S., & Berndorff, D. (2002). Interest, learning, and the psychological processes that mediate their relationship. *Journal of Educational Psychology, 94,* 545-561.

Borget, M. M., & Gilroy, F. D. (1994). Interests and self-efficacy as predictors of Mathematics/science-based career choice. *Psychological Reports, 75*, 753-754.

Brotman , J.S. & Moore, F.M (2008) Girls and science: A review of four themes in the science education *literature. J.Research in Science Teaching (45) pp. 971-1082.*

Calabrese-Barton, A., & Basu, S. J. (2007). Developing a sustained interest in science among urban minority youth. *Journal of Research in Science Teaching, 44*(3), 466-489.

Chang, C. Y., & Cheng, W. Y. (2008). *Science achievement and students' self-confidence and interest in science:* A Taiwanese representative sample study. *International Journal of Research of Science Education, 30*, 1183-1200.

Csikszentmihalyi, M. (1997*).* Finding flow: The psychology of engagement with everyday life. New York, *NY:Basic.(cf. Shumow and Schmidt 2014).*

Farenga, S. J., & Joyce, B. A. (1998). Science-related attitudes and science course selection: A study of high-ability boys and girls. *Roeper Review, 20*(4), 9, 247-251

Harter, S. "Effectance motivation reconsidered: Toward a developmental model". *Human Development*, 21(1), pp.34-64.

Glynn, S. M., Taasoobshirazi, G. and Brickman, P. (2009), "Science Motivation Questionnaire: Construct validation with non-science majors". *Journal of Research in Science Teaching 46, 127–146.*

Hidi, S. (1990). Interest and its contribution as a mental resource for learning. *Review of Educational Research, 60,* 549-571.

Greenfield, T. A. (1997). *Gender- and grade-level differences in science interest and participation.* Science Education, 81(3), 259–275.

Jarvis, T. and Pell, A. (2005) Factors influencing elementary school children's attitudes to science before, during and following a visit to the UK National Space Centre. *Journal of Research in Science Teaching 42(1), 53-83*

Kelly, A. (1986). The development of girls' and boys' attitudes to science: A longitudinal study. European Journal of Science Education, 8, 39F9-412.

Koballa, T. R., & Crawley, F. E. (1985). The influence of attitude on science teaching and learning. *School Science and Mathematics,* 85, 223–232.

Lavonen, J., Byman, R., Uitto, A., Juuti, K., & Meisalo, V. (2008). *Students' interest and experiences in physics and chemistry related themes: reflections based on a ROSE-survey in Finland.* Themes in Science and Technology Education, 1(1), 7–36.

Laukenmann, M., Bleicher, M., Fu, S., Gläser-Zikuda, M., Mayring, P., & von Rhöneck, C.(2003). An investigation of the influence of emotional factors on learning in physics instruction. *International Journal of Science Education,* 25, 489-507.

Lovelace, M. & Brickman, P. (2013). *Best Practices for Measuring Students' Attitudes towardLearning Science*. Life Sciences Education Vol. 12, 606–617. Downloaded from http://www.lifescied.org/ October 20, 2014

Mason, C. L., & Kahle, J. B. (1989). Student attitudes toward science and science related careers: A program designed to promote a stimulating gender-free learning environment. *Journal of Research in Science Teaching, 26*(1), 25-39.

Osborne, J., Simon, S., & Collins, S. (2003). Attitude towards science: A review of the literature and its implications. *International Journal of Science Education, 25(9), 1049-1079.*

Shumow, L. and Schmidt, J. (2014) *"Enhancing Adolescents' Motivation for Science"*, SAGE publication, California, pp. 112-114.

Said, Z, and. Friesen. H. (2013)."*The impact of educational reform on science and mathematics education in Qatar.*" European Scientific Journal 9, 19 (2013).

Said, Z. (2016a). *Science Education Reform in Qatar: Progress and Challenges*. Eurasia Journal of Mathematics, Science & Technology Education, 12(8), 2253-2265. doi:10.12973/eurasia.2016.1301a

Said, Z (2016b). *Developing a Framework for Effective Delivery of Practical in Science Teaching in the State of Qatar.* International Journal of Educational Science and Research, 6(2), pp. 25-33.

Shrigley, R.L., Koballa,T.R. & Simpson, R.D. (1988). *Defining attitude for science educators. Journal of Research in Science Teaching, 25*, 659-678.

Simpson, R. D., & Oliver, J. S. (1985). Attitude toward science and achievement motivation profiles of male and female science students in grades six through ten. *Science Education, 69(4), 511–526.*

Tobias, S. (1994). Interest, prior knowledge and learning. Review of Educational Research, 64, 37-54.

Tytler, R., & Osborne, J. (2012). Student attitudes and aspirations towards science. *In Second international handbook of science education (pp. 597-625).* Netherlands: Springer.

Weinburgh, M. (1995). Gender differences in student attitudes toward science: A meta-analysis of the literature from 1970 to 1991. Journal of Research in Science Teaching, 32(4), 387–398.

Yager, R. E. & McCormack, A. J. (1989*). Assessing teaching/learning successes in multiple domains of science and science education. Science Education, 73(1), 45-58.*

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 59-63

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Examination of Students' Metacognitive Awareness and Their Physical Problem Solving Strategies

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Abstract: Although studies suggest that metacognitive strategy instruction can promote increased problem solving in the classroom, little evidence has been collected that directly probes the role of metacognition in problem solving. This study examined high school students' metacognition and physical problem solving skills and looked for a relationship between the two. A correlational research design was carried out for this research. Participants of the study were eleventh graders studying in an urban all-boys school. The Metacognition Awareness Inventory was administered to determine the students' metacognition. Physical Problem Solving Assessment Inventory was used to assess the participants' problem solving strategies. Results showed that the students' metacognitive awareness level was close to high. Their knowledge about cognition was higher than their regulation of cognition. Additionally, the students' physical problem solving strategies were little. Results also presented that the more metacognitive awareness the students had the more knowledge of reading they had. Pearson correlation coefficient analyses indicated a significant medium level positive relationship between the students' metacognitive awareness and their physical problem solving strategies.

Keywords: Metacognitive awareness, Physical problem solving, High school students

Introduction

Since metacognition refers to higher-order mental process involved in using appropriate skills and strategies to solve a problem (Coutinho, 2007), learners' metacognitive ability allows them solving of problems successfully (Eric & Mansoor, 2007). Several cognitive processes and metacognitive strategies are integral to problem representation and problem execution and underlie successful problem solving (Mayer, 1998).

Metacognitive training programs were found effective for problem-solving strategies regardless of learning aptitude or achievement (Delclos & Harrington, 1991). Swanson (1990) indicated that metacognitive skills helped children of lower aptitude compensate on problem-solving tasks. In addition, Sperling, Howard, Miller and Murphy (2002) showed significant correlations between children's metacognitive awareness and problem solving strategies. However, more research is needed to examine the possible relationship between students' metacognition and their physical problem solving strategies. Therefore, the following research questions put a light on this research:

1. What is students' metacognitive awareness level?
2. What are students' physical problem solving strategies?
3. Is there a statistically significant relationship between physics students' metacognitive awareness and their physical problem solving strategies?

Methodology

A correlational research design (Creswell, 2008) was carried out for this research to examine the relationship between participants' metacognition and their problem solving strategies. Both qualitative and quantitative methods were used to collect and analyze the data in order to understand the possible relationship.

Participants and Settings

Participants in the study were eleventh graders studying in an urban all-boys school. Their ages were between 17 and 18 years old. The participants were taught geometrical optics and the related concepts such as light intensity and illumination in the eleventh grade. The students took physics for 4 h/week.

Role of the Researchers

Two researchers planned the research together but the first researcher collected the data. The first author was the teacher of the students. Hence, she had two roles. One was as a teacher and the other one was as a researcher. This situation enabled her to establish good communication with the students and to create an environment where the students felt comfortable about stating their thoughts. The students were ensured that their participation to the research and their responses would not affect their physics grades.

Data Collection and Analysis

Metacognitive Awareness Inventory

The Metacognition Awareness Inventory (MAI) developed by Schraw and Dennison (1994) was used in this study to determine the participants' metacognition. This inventory was selected among the similar instruments because it is valid, reliable and suitable for high school students. The MAI was a self-report instrument and consists of 52 items based on five-point Likert scale. There were 17 items related to knowledge about cognition and 35 items related to regulation of cognition. Items related to knowledge about cognition were distributed under the following components: declarative knowledge, procedural knowledge, and conditional or strategic knowledge. There were five components of regulation of cognition called: Planning, information management, monitoring, debugging, and evaluation.

The MAI was administered to all 95 eleven graders during their physics classes. The students completed the inventory in about 20 minutes. Participation was volunteered. Cronbach alpha value was found as .91 showing that the instrument used in this study had high internal consistency. Descriptive statistics were performed to determine the participants' metacognitive awareness. The students' mean values were ranged between 2.86 and 4.40. Therefore, their performances were assessed based on their mean scores where 2.86 – 3.37 was evaluated as low metacognitive awareness and labeled as Group 1, 3.38 – 3.89 was evaluated as medium metacognitive awareness and labeled as Group 2, and 3.90 – 4.40 was evaluated as high metacognitive awareness and labeled as Group 3. There were 24 participants in the Group 1, 45 participants in the Group 2, and 26 participants in the Group 3. Total of 30 students from each group (eight students from the Group 1, 14 students from the Group 2, and eight students from the Group 3) with a 30% sampling ratio were selected randomly to examine the relationship between metacognition and problem solving.

Physics Problem Solving Assessment

In order to determine the participants' physical problem solving skills, Physical Problem Solving Assessment (PPSA) inventory was prepared by considering the short form of the Mathematical Problem Solving Assessment (MPSA) inventory developed by Montague (1992). Items about perception and attitude were taken out from the Mathematical Problem Solving inventory. The PPSA had two parts. The first part included 10 open-ended questions assessing physical problem solving strategies. The second part consisted of five authentic physics problems. The questions in the first part were distributed under four components of physical problem solving strategies. There were three questions related to the knowledge of problem solving strategies component, three questions related to the knowledge of reading component, two questions related to the use of reading component, and two questions related to the control of reading component. The subject of the physics problems was photo electric.

The selected 30 students were requested to complete the PPSA in the teacher's office. In order to analyze students' problem solving strategies assessed in 10 questions, the researchers prepared a rubric and calculate the score of each participants. The minimum score one can be obtained from this rubric corresponds to 10 whereas the maximum score is 50. Cronbach alpha value was found as .79 for the PPSA showing that the inventory was reliable. The physics problems in the PPSA was not used in this research. Pearson correlation coefficient analysis was performed to find an answer for the third research question.

Results and Discussion

Table 1 shows the students' mean values gathered from the MAI and its components. According to the table, the students' metacognitive awareness level was close to high (M = 3.69). Their knowledge about cognition (M = 3.76) was higher than their regulation of cognition (M = 3.62). This means that the students' knowledge of their own cognitive process was better than their control over their own cognitive process. Moreover, the students' conditional knowledge was high (M = 3.96). That is, they had awareness of the conditions that influenced their learning such as why strategies were appropriate (Deseote et al., 2001). The participants could also debug well (M = 3.87). In other words, they could fix strategies to correct comprehension and performance errors (Schraw & Dennison, 1994).

Table 1. The students' mean values based on the MAI and its components

	Meta-cognitive awareness	Knowledge about cognition	Regulation of cognition	Declarative knowledge	Procedural knowledge	Conditional knowledge	Planning	Monitoring	Evaluation	Debugging strategies	Information management
M	3.69	3.76	3.62	3.77	3.56	3.96	3.66	3.44	3.56	3.87	3.58

The overall mean value for the students' physical problem solving strategies was 16.52, which was low regarding that the highest value was 50. This finding indicates that the students did not much read physics problems, could not define what were given in the problem and what was asking, did not make a plan or a specific activity to solve the problem, and could not analyze and check the solution every time they solved the problem. Table 2 presents the groups' mean values obtained from 10 questions of the PPSA. As the groups were determined based on their metacognitive awareness, the third group had the highest metacognitive level. According to the table, there was not a statistical significant difference among the groups' physical problem solving strategies (p = 0.17 > 0,05). Although the students' problem solving strategies increased as their metacognitive level increased, this connection was not significant.

Table 2. Groups' mean values of physics problem solving strategies

Groups	N	M	SD	Min.	Max.	SE	F	p
First Group	8	14.25	3.62	1100	20.00	1.28	1.92	0.17
Second Group	14	16.43	5.80	10.00	26.00	1.55		
Third Group	8	18.88	3.23	14.00	24.00	1.14		

Table 3 demonstrates the groups' mean values of the components in physical problem solving strategies. It can be seen from the table that the students got the highest score in the knowledge of reading component (M = 5.70) among the other components. The maximum score one can earned from this component was 15; therefore, this result showed that they sometimes read and tried to understand the physics problems. On the other hand, the students got the lowest score in the control of reading component (M = 3.10) out of 10. The students rarely asked themselves questions about understanding the physics problem. There was a significant difference among the groups' problem solving strategies in the knowledge of reading component (p = 0.05). That is, the more metacognitive awareness the students had the more knowledge of reading they had.

Pearson correlation coefficient analyses presented in Table 4 showed a significant medium level positive relationship between the students' metacognitive awareness and their physical problem solving strategies (r = 0.56, p < .05). In other words, high metacognitive awareness might result in high problem solving strategies in physics. This result was consistent with the result that emerged from the research by Meijer, Veenman and van Hout-Wolters (2006) whose participants were secondary school students. They found substantial correlation between metacognitive activities and studying text and making assignments in physics. This finding supported what Sandi-Urena, Cooper and Stevens (2012) stated that problem-based lab instruction made improvement in college students' metacognitive skills.

Tablo 3. Groups' mean values of the components in problem solving strategies

Component	Groups	N	M	SD	SE	Min.	Max.	F	p
Knowledge of problem solving strategies	First	8	3.88	1.13	0.40	3.00	6.00		
	Second	14	4.50	1.99	0.53	3.00	9.00		
	Third	8	5.13	1.25	0.44	4.00	7.00	1.18	0.32
	Total	30	4.50	1.63	0.30	3.00	9.00		
Knowledge of reading	First	8	4.50	1.07	0.38	3.00	6.00		
	Second	14	5.71	2.30	0.62	3.00	9.00		
	Third	8	6.88	1.46	0.52	5.00	10.00	1.19	0.05
	Total	30	5.70	1.99	0.36	3.00	10.00		
Use of reading	First	8	2.88	0.99	0.35	2.00	5.00		
	Second	14	3.14	1.10	0.29	2.00	5.00		
	Third	8	3.62	1.69	0.60	2.00	7.00	0.24	0.49
	Total	30	3.21	1.24	0.23	2.00	7.00		
Control of reading	First	8	3.00	1.31	0.46	2.00	5.00		
	Second	14	3.07	1.14	0.30	2.00	5.00		
	Third	8	3.25	1.04	0.37	2.00	5.00	0.71	0.91
	Total	30	3.10	1.12	0.21	2.00	5.00		

Table 4. Correlation analyses between metacognitive awareness and physics problem solving strategies (N=30)

Pearson Correlation		Metacognitive Awareness	Physics Problem Solving Strategies
Metacognitive Awareness	Correlation Coefficient Sig. (2-tailed)	1	0.56 0.01
Physics Problem Solving Strategies	Correlation Coefficient Sig. (2-tailed)	0.56 0.01	1

Conclusion and Suggestion

Metacognition plays a critical role in successful learning; hence, it is important to study metacognition and to determine how students can be taught to apply their cognitive resources through metacognitive control (Livingston, 2003). Despite numerous efforts to increase students' problem-solving abilities, many still fail to solving problems even when they are simply required to apply an algorithm in order to obtain the 'correct' solution (Lorenzo, 2005). Although studies suggest that metacognitive strategy instruction can promote increased problem solving in the classroom, little evidence has been collected that directly probes the role of metacognition in problem solving (Sandi-Urena et al., 2012). This research examined high school students' metacognition and physical problem solving skills and looked for a relationship between the two. It can be concluded from the study that although eleventh graders' metacognitive awareness is in reasonable level, they cannot use physical problem solving strategies much. In addition, there is a relationship between students' metacognitive awareness and their physical problem solving strategies. Hence, this research study suggests that enhancing metacognitive awareness can facilitate problem solving.

References

Coutinho, S. A. (2007). The relationship between goals, metacognition, and academic success. *Educate Journal, 7*(1), 39-47.

Creswell, J. W. (2008). Educational research: Planning, conducting, and evaluating quantitative and qualitative research (3rd. Ed.): Pearson Education, pp. 640.

Delclos, V. R., & Harrington, C. (1991). Effects of strategy monitoring and proactive instruction on children's problem-solving performance. *Journal of Educational Psychology, 83*(1), 35–42.

Desoete A., Roeyers H., & Buysse A. (2001). Metacognition and mathematical problem solving in grade 3. *Journal of Learning Disabilities, 34*(4), 435.

Eric, C. C. M., & Mansoor, N. (2007). Metacognitive behaviors of primary 6 students in mathematical problem solving in a problem-based learning setting.

Lorenzo, M. (2005). The development, implementation and evaluation of a problem solving heuristic. *International Journal of Science and Mathematics Education. 3*, 33-58.

Livingston, J. A. (2003). *Metacognition: An overview*. ERIC Document No Ed 474273.

Mayer, R. E. (1998). Cognitive, metacognitive, and motivational aspects of problem-solving. *Instructional Science, 26*, 49.

Meijer, J., Veenman, M. V. J., & Van Hout-Wolters, B. H. A. M. (2006). Metacognitive activities in tekst-studying and problem-solving: Development of a taxonomy. *Educational Research and Evaluation, 12*(3), 209–237.

Montague, M. (1992). The Effect of Cognitive and Metacognitive Strategy Instruction on the Mathematical Problem Solving of Middle School Students with Learning Disabilities. *Journal of Learning Disabilities, 25*(4), 230-248.

Sandi-Urena, S., Cooper, M., & Stevens, R. (2012). Effect of cooperative problem-based lab instruction on metacognition and problem-solving skills. *Journal of Chemical Education, 89*(6), 700–706.

Schraw, G., & Dennison R. S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology, 19*, 460-475.

Sperling, R. A., Howard, B. C., Miller, L. A. & Murphy, C. (2002). Measures of Children's Knowledge and Regulation of Cognition. *Contemporary Educational Psychology 27*, 51–79.

Swanson, H. L. (1990). Influence of Metacognitive knowledge and aptitude on problem solving. *Journal of Educational Psychology, 82*(2), 306–314.

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ISRES Publishing

The Eurasia Proceedings of Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 64-70

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Using Students' Self Reflection to Improve Motivation and Engagement in Learning Physics

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Abstract: The traditional method of teaching advanced physics courses is modified by introducing a new item in teaching, namely students' reflection throughout the semester. Students are asked to reflect on different items in their course and in particular to reflect on their achievement, struggles, goals, and skills. Students are encouraged to be open, direct, and to give details as much as possible. Consequently, instructors felt the mentor and facilitator connection with students that strengthened the feeling of academic responsibility. On the other hand, students expressed positive experience and were less concentrated on the minute details of the course but rather on a general and global picture of learning experience. This connected students with their goals, it reminded them of their struggle, confusion, and growing up experience during the process.
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Keywords: Physics education, Students' reflection, Portfolio learning, Learning engagement

Introduction

The learning and teaching experience in higher education science programs, particularly in physics, compromises several highly challenging factors that feed into the instructor/students teaching/learning process. This includes a collection of cognitive and psychological factors that dynamically intertwine, such as content understanding, memory retrieving, communication skills, critical thinking, mathematical skills, expectations of learners and instructors, attitudes, motivation, goals, believes, and more. Challenges in learning and teaching physics in higher education have been investigated and shared by many researchers, such as, (Linder, 1992; McDermott, 1999; Osborne, 1990; Redish, 2003; Tobias, 1992), to name but a few. Many studies are focusing on students who are taking introductory physics courses (Aalst, 2000; Allen, 1996; Halloun, 1985a; 1985b; Hammer, 1994; Obaidat, 2008; May, 2002; Redish, 1998). Researchers in those studies have investigated several factors that are considered to affect students' attitudes towards understanding of physics concepts in introductory physics courses. Ineffective instruction methods, students' misconceptions about the physical world, negative attitudes toward physics, lack of critical thinking, insufficient mathematical skills, poor problem-solving skills, and ineffective testing and evaluation methods are surely some of the possible factors. Other researchers focus on teachers' beliefs and attitudes in shaping education and students experience (Abd-El-Khalick, 2000; Belo, 2013; Iqbal, 2009; Hativa, 2002; Lederman, 1992; Mulhall, 2012).

Conventional teaching method has been shown as ineffective in shaping students understanding of physics concepts leading to innovations in physics education (DeHann, 2005; Lyons, 2006; Redish, 1999; Tobias, 1992). New developments in class room physics (Thacker, 2003) include several innovations such as enhanced attention to conceptual understanding, problem-based learning, hands-on techniques, and use of technology. Despite the large body of research on physics education there is little impact on teaching physics courses in universities worldwide (Sin, 2014; Tytler, 2007) as the conventional method of teaching physics still dominant, including most parts of the middle east and in particular at United Arab Emirates University (UAEU). By conventional method we mean students learn through traditional lectures and where students act as passive receptors. Content focuses on facts, standard equations and formulas, and numerical problems that create the illusion that physics is not clearly related to real life and actual challenges in scientific research. In the conventional method, engagement of students in the learning process is not a major part of the teaching and assessment process.

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

One of the suggestions to change traditional method of instruction is to include students' portfolios in the course structure. Portfolios are used in education and professional development for learning, assessment, promotion and appraisal. Portfolios emphasize the collection of work which includes a reflective commentary (Arter, 1992; Baume, 2001; Jarvinen, 1995) and are used particularly for the purposes of developing teaching skills and reflective practice in all teaching levels (Hutchings, 1998; Lyons, 1998). Often in higher education the portfolio is used to demonstrate evidence of achievements for summative purposes (Baume, 2002; Nystrand, 1993). Using learning portfolios shifts the instructor's responsibility from being an expert to a guide and facilitator. The relationship between instructor and students in the portfolio approach is more equal. Feedback in this case becomes a form of a dialogue in which both instructor and students are learners (Klenowski, 2006). Reflection is an important factor in portfolio approach in education, where students can develop reflective thoughts on issues written up during, in between or at the end of the course (Schon, 1987). Portfolios can be used to record ideas, beliefs, and arguments taken on issues, this leads to development of critical thinking skills (Klenowski, 2006).

In this work we focus on using students' reflection in advanced physics courses and throughout the course semester. We do not employ the portfolio technique in teaching at this stage, rather we only direct students to express their own thoughts, expectations, struggles, and learning experience during different stages in the course semester. Students are encouraged to be open, direct, and have the freedom to add details as much as they feel needed. The reason we consider advanced courses only is because students are more mature with higher sense of responsibility. Also, the number of enrolled students in advanced courses at UAEU is low, thus we believe that instructors will be less intimated by the extra work and effort needed to monitor students' reflections and provide feedback. In the next section we report on our experience in teaching two advanced physics courses using students' reflection as part of the pedagogy and assessment.

Students' Reflection in Advanced Physics Courses

Teaching advanced courses in the physics department at UAEU mainly follows the traditional method of delivering lectures where students act as passive receptors. Recently some changes have been implemented to few advanced courses such as creating new PowerPoint lectures and showing few videos and animations. However, nothing substantial has been changed in pedagogy, assessment, or attitudes of instructors or students. There is a clear hesitance in the department to adopt new pedagogy in teaching advanced physics courses. Instructors are always worried about the amount of effort and time needed to adapt to new methods, as well as the effectiveness of such methods is always in question. Therefore, we believe that a gradual change in method of teaching accompanied by a change in mind setting of instructors and students is the best practice. Due to low enrollment in physics students at the undergraduate level at UAEU, we do not expect time and effort to be major obstacles.

Recently, we have introduced a new factor in the process of teaching and assessment to engage students in their learning experience through continuous reflection on their progress during the course semester. Students' reflection usually is part of implementing the portfolio technique in teaching, however, at this stage we only concentrate on the reflection part. Students' reflection is performed electronically on the Blackboard platform that is provided by the university. Given the low enrollment of physics students in advanced courses the process will not take much of the instructor's time but on the contrary it is found to stimulate the interest of instructors in the process. To encourage students in participating in this new experience, a percentage of the final grade of the course was dedicated to this contribution. Also, specific deadlines were set for receiving the students' reflection throughout the semester.

What we are interested in this article is to provide insight into the impact of students' reflection in advanced physics courses on their attitudes, achievement, and assessment. Students reflection has been implemented in two physics courses at the senior level. The first course is Quantum mechanics and the second is Mathematical Physics. Throughout the semester students were asked to reflect on different parts of the course and at different times during the semester. At the beginning of the semester students were asked to comment on three major points; their expectations from the course, their strengths, and their weakness as learners. The question on students' expectations of the course is important as instructor gains insight onto students thinking and expectations of the learning outcomes of the course. Rather than directing the students into reading the existing learning outcomes, we prefer to explore the students' expectations of what they think and hope to achieve in the course. It also reflects the level of students' appreciation of the importance and relevance of the course.

Examples of excerpts from students' expectation in Quantum Mechanics are shown below as posted by students and without editing as English is a second language for students. One student writes: "My expectations from this course: I will have knowledge in quantum mechanics as a physics student should have, I will be able to explain general quantum phenomenon, and solve quantum math problems." Another student writes

> My expectation in this course is to learn the fundamental concepts of Quantum mechanics by using Schrodinger's equation which can solve quantum mechanics problems and, as result of it I will be able to add to my learning the mathematical skills needed to solve quantum problems which hopefully will lead me finally to discuss or understand the microscopic world.

Another student writes:

> I expect to learn a lot of things in this course. Firstly, I would like to understand the fundamental concepts of quantum mechanics and its application n life and why classical mechanics is not the right theory of nature in certain situations. In addition of applying the recommended techniques that can be used while solving quantum mechanics questions such as Schrodinger equation, operators and Eigen functions. Beside using the tools, methodologies, language and conventions of physics to test and communicate ideas of quantum mechanics.

An interesting contribution from another student is:

> Quantum mechanics has been an intimidating experience for past students, I expect it to be slightly harder than the previous courses, however I believe I will be able to understand the basics of the course throughout the semester. I expect this course to discuss particles and their movement and positions using mathematical methods, and it will include the uncertainty (particle in a box) concept in those calculations.

Another example is from the Mathematical Physics course:

> I believe that once I've successfully completed this course that I'd be much more familiar and comfortable with reading mathematical notations in complicated fields. I would expect that I'd be very fluent using them as well. Furthermore, I reckon that there will be a link between those learned skills and physical applications.

Students have their own view of the course learning outcomes and what they expect to learn. In general, we find that students views are compatible to large extent with the actual course learning outcomes. Also we notice that some students have a labeling scheme to some courses, such as the Quantum Mechanics course is hard which could affect their commitment and attitudes toward the course. This course labeling is transferred through students' interactions and communication.

Another question that students were asked at the beginning of the semester is to reflect on their weaknesses and strengths as learners. Students were asked to be honest in reflecting on this point and were told that their reflection will be set to private on the electronic platform where only instructors were allowed to read students response. Here we provide some excerpts from students' answers. One student writes passionately:

> My strengths: I'm able to learn fast. My weaknesses: I thought I was good in math, but when I took electromagnetic theory last semester, I realized I'm so far behind, and the reason is I didn't take the needed math concepts in university, Calculus 1 and 2 were easy to me but when I took linear algebra, unfortunately, I did really bad, and got D, we took ordinary differential equations course and I got B+, in mathematical physics we just had 2 chapters on coordinates double and triple integrations and vectors. So my math knowledge is really weak; I don't know complex numbers, partial differential eq. I was motivated at the beginning to continue in physics after graduation, but unfortunately after I realized that I'm not taking real physics, and maybe my sister in school knows physics more than me. and the math knowledge Is also weak, I really lost motivation and I am looking for another field to continue my Master in.

Another student writes:

> I enter this course after learning advanced mathematics, high level of physics courses, basic Philosophy and I think I can be fine with quantum mechanics course if I work hard for it. So I can say that my strength points are critical thinking and problem solving and dealing with high level of mathematical physics problems and the ability to find and prepare the needed notes of the course from different sources such as library and online learning. However, I have some weakness in some areas such as computational physics, statistical physics, electromagnetic theory because I didn't learn these subjects yet and I am afraid that quantum mechanics is related to them in the same math or same concepts so I hope from you doctor to make a small revision for us at the beginning if quantum is related to these subjects.

It was a surprising experience for the instructor to read students input and how students were explicit in pointing out the struggle and frustration they were experiencing as students. Students were passionate in describing their struggle in their physics courses and experience as students. This part was influential on the instructors' attitude and feeling of responsibility toward students. Instructors expressed support, guidance, and encouragement to students throughout the semester, pointing out that struggle is an indispensable part of learning.

Next step was to ask students to reflect whenever they submit a homework or perform a test. Students were asked to evaluate their understanding of the material and wither practicing solving the homework has played a role in enhancing performance and understanding. It was always interesting for the instructors to read students comments and connect with their struggle. In the middle of the semester students were asked to reflect on their achievements and efforts. Also, they were asked to compare their initial expectations with their experience in the course so far. This gave students a time to pause and rethink about what has been accomplished and what has been missed. They reflected on the adequacy of their efforts and some students expressed their intention to modify their study plans for the course. We find this self-evaluation is critical to keep students on track during the semester as they easily get distracted by other factors beyond the course. We find students' self-reflection to be helpful for both the student and instructor. The instructor can use the students' reflection to rethink about the objectives of the course and how to handle issues that students find particularly important or confusing. We give only one response of a student from the Mathematical Physics course as the student writes:

> I believe that I have focused my entire attention on the material instructed in class and that I'm not lacking in that area. Although I work and practice a lot when it's time for the assignments and quizzes, I don't usually go over what I took in class when I go home. The constant tasks I keep getting throughout the past 3 weeks gave been overwhelming to the extent that I started sleeping almost 2 ~ 3 hours a day. And this hindered my ability to perceive the information in class in comparison to the beginning of the semester. I put up very high standards for myself before commencing any course, so anything other than a full mark is usually a disappointment. The thing I do appreciate about myself is that when this happens, I get more motivated and work even harder than I previously did, to achieve the grade that I want. Apart from the grades, I'm quite satisfied with the grasp of the new concepts I learned, especially the dissection of uniform circular motion. To know how that equation came to be was very interesting. So far I'd say that my expectations were spot on. Personally, I find that the examples which correlate the math to the actual physical application help quite a lot in delivering the information.

At the end of the semester students were asked to reflect on the whole course and reflect on the following items as explicitly and thoroughly as they find appropriate:

1) Did you work enough on achieving your expectations? explain
2) Did you accomplish your expectations? explain
3) What are your comments about the course and what have you learnt, and how the course could be improved?
4) Write general comments on your personal goals and whether the course has made any change.

Here we list few excerpts from students' responses in Quantum Mechanics. One student writes:

> The course was really challenging for me, but I'm very happy and satisfied that I took quantum mechanics as one of the most important courses in physics with you doctor, it was a very great experience, you have no idea how much I learned in this course. I might not get a high grade, but I know myself that I understood the basics of quantum mechanics pretty well! and I'm very confident about it. I did my best in this course, and I really enjoyed the

> material. It was a pleasant experience to me, taking a course with you, because it brought back my confidence in physics again. Please doctor keep doing the reflection idea for the next generations, it is an excellent idea to make your students improve, it makes them know where they are and know how to solve their problems. Your way of explaining is the best in our department with the agreement of all students and other professors. I'm very happy that I took my last physics course in my undergraduate with you. As for my personal goals, I'm a person who is passionate about learning, I have taken business, science, engineering and IT courses, inside and outside university, but the thing I loved the most since I was 10 years old is everything about computer... I just feel happy whenever I do or develop anything in computer. So I want to continue my masters in Software engineering, most likely in our university, and then do my PhD as well. the field that I want to specialize in IT the field of Big Data and Data Mining. This field has so many applications in science especially in physics. So my plans are to find a nice application that connects both physics and data mining together and do my master degree in it. Thank you doctor for everything you have done. Have a happy and relaxing summer with your family.

Another student writes:

> Going into this course, I honestly was more scared of the difficulty of Quantum Mechanics, than I had any expectations or inspirations. Of course, I expected it to be hard and I was willing to study hard for most of the time. I wanted to get a high mark in this course, to challenge myself and prove that if I had worked hard at the beginning, I would have been a much better student with better grades. However, I felt that I did not live up to my expectations and was lazy to study most of the time. It had nothing to do with the course or the instructor. Actually, I find Quantum Mechanics to be the most exciting subject I took so far. From the Schrodinger equations to the angular momentum. But again, I have the habit of procrastination that hindered my progress in the course. But if there is one thing that I am proud of, it would be that I did everything I could that I dedicated 3 continuous days for the final exam. Therefore, I think I did well in the final compared to my overall performance during the course. On a side note, I would suggest to have a small bonus pop quiz just to make the student motivated for the course. Moreover, a more frequent homework and project would have had motivated me to study more. Other than that, I think the course structure was well-organized. In the end, I would like to say that this course had made me see how hard physics could be. And a course like Quantum Mechanics needs a consistent student with the motivation to learn and challenge himself. Although I was not that kind of a student, I think at least, my motivation in the final week made me do the impossible, and cover most of the subject in a relatively short time. Quantum Mechanics is captivating, but it needs a consistent hard work!

Another student writes:

> I think quantum mechanics was fairly difficult, even though I knew that, I still struggle in the course. I believe I have worked hard, but not hard enough. I study the notes and homework, but I don't refer to the text book for detailed explanation and more examples I was expecting to know the basics of quantum mechanics, and I think I managed to achieve that. (Such as the infinite potential well). This course helped me improve my skills in mathematics. It helped me create better bonds with my classmates, and that's duo to the study groups we used to do to solve homework and project. For my personal goals, I aim to graduate and start the next phase of my life, this course was a step in the right direction.

Students reflections during the courses semester were influential on the instructors. They provided a personal link between the instructor and students. Instructors feeling of academic responsibility were strengthened and the awareness of students' struggle and frustration created a connection between instructors and students. The experience of reflection was enjoyed by both students and instructors as well. Students expressed satisfaction with this method of writing about their struggles and experience throughout the semester. Instructors are more determined to repeat the experience in future courses.

Conclusion

Our experience with students' reflections throughout the course semester was positive. As instructors we felt a personal connection with our students that strengthened our feeling of academic responsibility. Reflections expressed by students exposed some of the struggles and frustrations that students feel toward their courses, instructors, learning experience, and personal life. One cannot disassociate students learning experience in class from the overall issues and experience they having as students and young adults. We think that instructors' involvement and connection with students directly promote the case were instructors act as mentors and facilitators. On the other hand, we find that students find reflection a useful act throughout the semester. It opens students' eyes into their learning experience and progress. It takes them away from the minute details of the course into the general and global picture of learning experience. It connects them with their goals and attitudes, it reminds them of their struggle, confusion, and growing up during the process. Any course taken by students should not be looked at as a disconnected piece from their overall learning experience. Rather it should be looked at as an integrated piece into their overall learning process. We do not claim this method will boost the achievement of students in the course as few students finished the course with low grades. However, both the student and instructor were aware of the struggle and effort made by the student throughout the whole semester. We think that this self-reported awareness of the students may have some positive effect on their learning and working experience in the future.

Recommendations

We plan to repeat this method in the next coming semesters to collect more data to be analyzed systematically. We encourage other instructors to adapt this technique in their teaching and observe enhancement in students' engagment.

Acknowledgements or Notes

The author would like to thank the United Arab Emirates University for their financial support.

References

Aalst, J. V. & Key, T. (2000). Pre-professional students' beliefs about learning physics. *Canadian Journal of Physics, 78*(1), 73-78.

Abd-El-Khalick, F. & Lederman, N.G. (2000). Improving science teachers' conceptions of nature of science: A critical review of the literature. *International Journal of Science Education, 22*(7), 665–701.

Allen, D. E., Duch, B. J., & Groh, S. E (1996). The power of problem-based learning in teaching introductory science courses. *New Directions for Teaching and Learning*, 43–52.

Arter, J., & Spandel, V. (1992). NCME instructional module: Using portfolios of student work in instruction and assessment. *Educational Measurement: Issues and Practice, 11*(1), 36-44.

Baume, D. (2001). A briefing on assessment of portfolios. LTSN Generic Centre Assessment Series, No. 6. York: Learning and Teaching Support Network (LTSN).

Baume, D. & Yorke, M. (2002). The Reliability of Assessment by Portfolio on a Course to Develop and Accredit Teachers in Higher Education. *Studies in Higher Education. 27*(1), 7-25.

Belo, N. A. H. (2013). *Engaging students in the study of physics: An investigation of physics teachers' belief systems about teaching and learning physics* (Doctoral dissertation). Retrieved from http://hdl.handle.net/1887/20703.

DeHaan, R. L. (2005). The impending revolution in undergraduate science education. *Journal of Science Education and Technology, 14* (2), 253–269.

Halloun, I. A. & Hestenes, D. (1985a). Common sense concepts about motion. *American Journal of Physics, 53*, 1056-1065.

Halloun, I. A. & Hestenes, D. (1985b). The initial knowledge state of college physics students. *American Journal of Physics, 53*, 1043-1055.

Hammer, D. (1994). Epistemological beliefs in introductory physics. *Cognition and Instruction, 12*(2), 151-183.

Hativa, N. & Goodyear, P. (2002). Teacher thinking, beliefs and knowledge in higher education. Netherlands: Kluwer Academic Publisher.

Hutchings, P. (1998). The course portfolio: How faculty can examine their teaching to advance practice and improve student learning. Washington, DC: American Association for Higher Education. Retrieved from http://files.eric.ed.gov/fulltext/ED441393.pdf.

Iqbal, H. M., Azam, S. & Rana, R.A. (2009). Secondary school science teachers' views about the nature of science. *Bulletin of Education and Research, 31*(2), 29-44.

Jarvinen, A. & Kohonen, V. (1995). Promoting professional development in higher education through portfolio assessment. *Assessment and Evaluation in Higher Education, 20*(1), 25–36.

Klenowski, V., Askew, S. & Carnell, E. (2006). Portfolios for learning, assessment and professional development in higher education. *Assessment & Evaluation in Higher Education, 31*(3), 267–286.

Lederman, N. G. (1992). Students' and teachers' conceptions of the nature of science: A review of the research. *Journal of Research in Science Teaching, 29*, 331–359.

Linder, C. J. (1992). Is reflected epistemology a source of conceptual difficulty in physics? *International Journal of Science Education, 14*(1), 111-121.

Lyons, T. (1998). Reflection in Teaching: Can It Be Developmental? A Portfolio Perspective. *Teacher Education Quarterly, 25*(1), 115-127.

Lyons, T. (2006): Different countries, same science classes: Students' experiences of school science in their own words. *International Journal of Science Education, 28*(6), 591-613.

May, D. B. & Etkina, E. (2002). College physics students' epistemological self-reflection and its relationship to conceptual learning. *American Journal of Physics, 70*, 1249.

McDermott, L. C. & Redish, E.F. (1999). RL-PER1: Resources letter on physics education research. *American Journal of Physics, 67*(9), 755-767.

Mulhall, P. & Gunstone, R. (2012). Views about learning physics held by physics teachers with differing approaches to teaching physics. *Journal of Science Teacher Education., 23*, 429-449.

Nystrand, M., Cohen, A. S., & Dowling, N. M. (1993). Addressing Reliability Problems in the Portfolio Assessment of College Writing. *Educational Assessment, 1*(1), 53-70.

Obaidat, I. & Malkawi, E. (2008). Enhancing learning physics through challenging the methods of evaluation. *International journal of scientific research, 17*, 147-152.

Osborne, J. (1990). Sacred crows in physics-towards a redefinition of physics education. *Physics Education, 25*(4), 189-196.

Redish, E. F. (2003). Teaching physics with the physics suite. Hoboken, NJ: Johns Wiley & Sons, Inc.

Redish, E. F., Saul, J. M., Richard N. & Steinberg, R. N. (1998). Student expectations in introductory physics. *American Journal of Physics, 66*, 212.

Redish, E. F., & Steinberg, R. N. (1999). Teaching physics: Figuring out what works. *Physics Today, 52*(1), 24–30.

Schon, D. A. (1987). Educating the reflective practitioner: Toward a new design for teaching and learning in the professions. San Francisco: Jossey-Bass.

Sin, C. (2014). Epistemology, Sociology, and Learning and Teaching in Physics. *Science Education, 98*, 342–365.

Thacker, B. A. (2003). Recent advances in classroom physics. *Reports on Progress in Physics, 66*(10), 1833–1864.

Tobias, S. (1992). Revitalizing undergraduate science: Why some things work and most don't. Tucson, AZ: Research Corporation.

Tytler, R. (2007). Re-imagining Science Education : Engaging students in science for Australia's future. Australian Education Review. Retrieved from https://research.acer.edu.au/cgi/viewcontent.cgi?article=1002&context=aer.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 71-78

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Content Analysis of Science Textbooks' Evaluation Questions Based on Physics, Chemistry, Biology, Environment and Astronomy Subject Area by Bloom's Taxonomy

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Abstract: The aim of this study is to determine the distribution of the units in the 6th, 7th and 8th grade science textbooks according to the contents of Biology, Physics, Chemistry, Environment and Astronomy learning domains and analyze the evaluation questions in these units according to Bloom's Taxonomy. The 6th, 7th and 8th grade science textbooks prepared in the framework of 1926, 1948, 1974, 1992, 2000, 2004 and 2013 science programs constitute the sample of this work. Questions to be considered in the study were evaluated independently by two field experts and the results were compared. As a result of the analyzes, it was determined that physics, biology, chemistry, environmental units were mainly included in every program but the number of astronomy units was less and only included in 6th and 7th grades' science textbooks. According to the Bloom's Taxonomy, when the questions are evaluated, it is determined that the questions in the Synthesis and Evaluation levels are insufficient and the questions in the Knowledge and Understanding levels are excessive. Based on the subject area, biology units' evaluation questions in 1948 program , the physics units' evaluation questions in 2013 program, the Astronomy units' evaluation questions in 1926 program and chemistry units' evatluation questions in 2000 program are prepared at the upper level based on Bloom's taxsonomy.

Keywords: Bloom's taxonomy, Content analysis, Textbook, Science education

Introduction

The aim of this study is to determine the distribution of the units in the 6th, 7th and 8th grade science textbooks according to the contents of Biology, Physics, Chemistry, Environment and Astronomy learning domains and analyze the evaluation questions in these units according to Bloom's Taxonomy.

In Turkey, Science education program had many revisions and had different names (1926, 1948, 1974, 1992, 2000, 2004 and 2013). In order to adapt to changing world conditions. In this process, new science textbooks have been written so that the new understandings in the programs can be used in learning environments. Textbooks are one of the complementary elements of the curriculum. They are the basic materials for studying and explaining the information of the subjects in the curriculum in a planned and regular way and as a source of information, to guide and educate the student towards the goals of the course (Ünal and Güneş, 2002). In particular, the quality of the questions in the textbooks has a great influence on the success of the students (Riazi and Mosalanejad 2010). This is because the textbooks have the highest contribution to the development of cognitive, emotional and psychomotor skills of students (Demirel, 2011).

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

History of Primary Science Curriculum in Turkey

Throughout the history of Republic of Turkey, Science Education program had several changes and revisions based on new development in Educational Research area. Mainly, there are seven different science education program in History including 1926, 1948, 1974, 1992, 2000, 2004 and 2013 programs.

1926 program is the public education program, which was designed according to the child-specific and focus on close environmental principles. 1936 program is organized to get rid of the deficiencies of 1926 program. Characteristics of the program includes (1) Giving information according to student's level, (2) Teaching in the environment and in the natural environment, (3) Consideration of individual differences, (4) Collective education and (5) Focus on distant environment (Arslan, 2000; Çepni and Çil, 2011).

Prior to 1948 program, the 1936 program was implemented in urban villages (Tekışık, 1992). This program, which was enacted between 1948 and 1949, is known as the longest curriculum in Republic of Turkey's history (Gözütok, 2003). In this program, Mathematics, Family Science and Agriculture-Business lessons are given in the first semester classes in the Life Science units. In the second semester classes, the students will be given importance to gain information by direct observation and experimentation (Power and Captain , 1992).

In 1974 Program, the name of the course was changed to "Science Information" (Fen Bilgisi) and some changes were made in the scope of the unit (Gücün and Kaptan, 1992). In this program, the emphasis was to provide scientific information through scientific processes. It was emphasize on importance of social benefit philosophy and technology (Gücün and Kaptan, 1992).

1992 program, even is not explicitly name it, it was focused on hand-on, minds-on learning and teaching (Demirbaş and Yağbasan, 2005). However in the program teacher-centered approach was over-emphasized (Turgut, 1990). During 2000 program, the science curriculum prepared according to scientific processes (Göktürk, 2003). The characteristics of the science curriculum were focus on active learning and teaching methodologies. The program was flexible enough to allow students to use their creativity without restricting teachers and textbooks

In 2004 program, the name of the course changed as "Science and Technology" (Çepni and Çil, 2011). The program prepared based on constructivist philosophy of teaching and learning. In the program, science content was mostly emphasis on everyday life and technology. The general objectives of the Science and Technology course curriculum aimed to have scientifically literate citizens (Ministry of National Education [MoNE], 2005). In 2013 program, name of the course changed again as a "Science". Program prepared based on constructivist philosophy of teaching and learning. Inquiry-based teaching methodologies was mainly emphasis on the program (MoNE, 2013).

Bloom's Taxonomy

In 1956, Bloom and his colleagues developed a classification system which we called today Bloom's Taxonomy. This classification method examines questions at different levels at the end of learning process.
Each level is measured by different types of questions (Table 1). This ranking is a classification of different thinking skills in a hierarchical order (Bloom, 1956). Bloom's Taxonomy of Cognitive Domain has lower-order thinking skills including knowledge, comprehension and application and higher-order thinking skills including analysis, synthesis, and evaluation (Cansüngü Koray and Yaman, 2002).

Table 1. Bloom's taxonomy of cognitive domain

	Cognitive Level
Lower-order thinking skills	Knowledge
	Comprehension
	Application
Higher-order thinking skills	Analysis
	Synthesis
	Evaluation

Bloom Taxonomy is used by teachers and researchers to determine the levels of questions (Dindar and Demir, 2006). In Turkey researchers usually use Bloom Taxonomy to analyze schools' exam questions level and placement test questions' level for primary schools (Ayvacı and Türkdoğan, 2010; Baysen, 2006; Dindar and Demir, 2006; Eş, 2005; Gündüz, 2009; Cansüngü Koray and Yaman, 2002; Özcan and Oluk, 2007).

Method

Qualitative research method was used in this study and document review method was used as information gathering method. A document review involves analysis of written materials that contain information about the events for investigation. In qualitative research, document review can be used as a stand-alone data collection method. Which documents are important and can be used as a data source is closely related to the research problem (Yıldırım and Şimşek, 2011).

In this study, Foster's document review steps were used. These steps are sequentially (1) Accessing documents, (2) Checking authenticity, (3) Understanding the documents, (4) Analyzing data, and (5) Using the data (Yıldırım and Şimşek, 2008).

Sample

3809 questions from 21 science textbooks (including 6th, 7th and 8th grade) from seven different science program were evaluated (Table 2). List of the science textbooks were given in Table 3.

Table 2. Years of books used in the research

	Curriculum						
Grade	**1926**	**1948**	**1974**	**1992**	**2000**	**2004**	**2013**
6th	1933	1955	1976	2000	2002	2012	2015
7th	1932	1959	1979	2000	2002	2012	2015
8th	1933	1954	1980	1998	2002	2012	2016

Table 3. List of the textbooks used in the study

Program	**Reference**
1926	Maarif Vekaleti (1933). *Fen bilgisi I. kitap.* İstanbul: Devlet Matbaası
	Maarif Vekaleti (1932). *Fen bilgisi II. kitap.* İstanbul: Devlet Matbaası
	Maarif Vekaleti (1933). *Fen bilgisi III. kitap.* İstanbul: Devlet Matbaası
1948	Tardu, B., Çağlayan M., ve Çağlayan, H. (1955). *Tabiat ve fen bilgisi I,* Ankara: Maarif Basımevi.
	Tardu, B., Çağlayan M., ve Çağlayan, H. (1959). *Tabiat ve fen bilgisi II*. Ankara: Maarif Basımevi.
	Tardu, B., Çağlayan M., ve Çağlayan, H. (1954). *Tabiat ve fen bilgisi III*, Ankara: Maarif Basımevi.
1974	Bayın, Ö., Güney, Ş. ve Özgen, R .(1976). *Fen bilgisi 1.sınıf.* İstanbul: Milli Eğitim Basımevi.
	Bayın, Ö., Güney, Ş. ve Özgen, R .(1979). *Fen bilgisi 2.sınıf.* İstanbul: Milli Eğitim Basımevi.
	Bayın, Ö., Güney, Ş. ve Özgen, R. .(1980). *Fen bilgisi 3.sınıf.* İstanbul: Milli Eğitim Basımevi.
1992	Çığırgan, H., Altıntaş, H., Özkan, H. ve Ay, M. (2000). *İlköğretim fen bilgisi ders kitabı 6*. İstanbul: Milli Eğitim Basımevi.
	Çığırgan, H., Altıntaş, H., Özkan, H. ve Ay, M. (2000). *İlköğretim fen bilgisi ders kitabı 7*. Eskişehir: Anadolu Üniversitesi Basımevi.
	Çığırgan, H., Altıntaş, H., Özkan, H. ve Ay, M. (1998). *İlköğretim fen bilgisi ders kitabı 8*. Eskişehir: Anadolu Üniversitesi Basımevi.
2000	Güngör, B., Yıldıran, N., Dökme, İ. ve Aydınlar, R. (2002). *İlköğretim fen bilgisi ders kitabı 6*. İstanbul: Milli Eğitim Basımevi.
	Büyük, Ş., Baş, B., Salmaner, V. ve Görür, N. (2002). *İlköğretim fen bilgisi ders kitabı 7.* Ankara: Basım Matbaacılık.
	Koyuncu, Ç., Kavas, B., Tiryaki, N. ve Salmaner, V. (2002). *İlköğretim fen bilgisi ders kitabı 8*. İstanbul: Milli Eğitim Basımevi.

2004	Taşar, M. F. (Ed.). (2012). *İlköğretim fen ve teknoloji ders kitabı 6.* İstanbul: Milli Eğitim Basımevi.
	Leblebicioğlu, G. (Ed.). (2012). *İlköğretim fen ve teknoloji ders kitabı 7.* İstanbul: Milli Eğitim Basımevi.
	Güneş, B. (Ed.). (2012). *İlköğretim fen ve teknoloji ders kitabı 8.* İstanbul: Milli Eğitim Basımevi.
	Ünsal, Y. (2015). *Ortaokul fen bilimleri 6. sınıf.* İstanbul: Milli Eğitim Basımevi.
2013	Özoğlu, H. H. & Mısırlıoğlu, Z. (2015). *Ortaokul fen bilimleri 7. sınıf.* Ankara: ADA Yayıncılık.
	Urhan, A. (2015). *Ortaokul fen bilimleri 8. sınıf.* Ankara: Tutku Yayıncılık.

Data Collection

In order to ensure the understanding of the documents, the units in the textbooks obtained are analyzed according to the Cognitive Process Dimension of the Bloom Taxonomy, which are arranged according to years. Below 1926 science textbooks units arranged based on the subject area (Table 4). This arrangement was done for all the grade levels and the programs.

Table 4. Distribution of science textbooks' units based on content are in 1926 science program

Grade	Unit number	Content area	Title of the Unit
	1	Astronomy	Üzerinde Yaşadığımız Arz
	2	Physics	Hava ve İklim
	3	Biology	İyi Yiyecek Elde Etmek
	4	Enviroment	İyi Bir Akarsu Temin Etmek
	5	Biology	Vücudun Zindeliğini ve Sıhhatini Muhafaza Etmek
6	6	Chemistry	Giyeceklerimizin İntihabı ve Muhafazası
	7	Biology	Kendimizi Hastalıklardan Korumak
	8	Chemistry	Ateşin Mahiyeti ve Kontrolü
	9	Physics	Binalarımıza Sıcak ve Taze Hava Temin Etmek
	10	Chemistry	Yapı Malzemesi
7	11	Physics	İş Yapıcı Makineler
	12	Physics	Havanın ve Suyun Kuvvetlerinden İstifade Etmek
	13	Physics	Kuvvei Muharrike için Buhar ve İnfilak Edici Gazdan İstifade
	14	Physics	Elektrik Elde Etmek ve Kullanmak
	15	Physics	Evlerimizi ve Sokaklarımızı Aydınlatmak
8	16	Physics	Konuşma, Dinleme Yolları ve Aletleri
	17	Physics	Kara, Su ve Hava Yolu ile Nakil İşleri

Data Analysis

Descriptive and content analysis processes were utilized during data analyzing. In this research, the cognitive process dimension of the Bloom's Taxonomy were determined by using the studies in the literature primarily according to the descriptive analysis approach. The questions obtained from the science textbooks were examined by the researcher and a specialist researcher taking into account the criteria table. In order to better understand which issue belongs to which step, a table containing the characteristics of each step was prepared.

Reliability and Validity

In order to measure the External Reliability of the study, 20% of the questions (762 questions) to be investigated were examined by the researcher at various time intervals according to Bloom's Cognitive Domain Steps. The result of the Cohen Kappa Coefficient was obtained as K = 0.82. To increase internal validity in qualitative studies, data are collected by more than one researcher (Büyüköztürk et al., 2010). For this purpose, 200 randomly selected questions were examined by a different researcher to determine the consistency between the evaluators. Kendall's coefficient was calculated as r = 0,78.

Results and Discussion

All science textbooks' units were checked and analyze to decide which units prepared for which subjects area including physics, chemistry, biology, environment and astronomy. According to Table 5, astronomy subjects only taught on 8th grades in 1948 program; environment subjects only taught in 8th grades in 1948, 1992, 2004 and 2013 programs. In all programs, 7th grade program has more content than other grades.

Table 5. Analysis of science programs textbooks' unit based on subjects

Grade level	Physics	Chemistry	Biology	Environment	Astronomy
6	1 (1926 prog)	1 (1926 prog)	2 (1926 prog)	1 (1926 prog)	1 (1926 prog)
	-	-	5 (1948 prog)	1(1948 prog)	-
	-	2 (1974 prog)	4 (1974 prog)	1 (1974 prog)	-
	3 (1992 prog)	-	2 (1992 prog)	1 (1992 prog)	-
	1 (2000 prog)	-	2 (2000 prog)	-	1 (2000 prog)
	4 (2004 prog)	1 (2004 prog)	2 (2004 prog)	1 (2004 prog)	-
	4 (2013 prog)	1 (2013 prog)	2 (2013 prog)	-	1 (2013 prog)
7	4 (1926 prog)	2 (1926 prog)	1 (1926 prog)	-	-
	4 (1948 prog)	1 (1948 prog)	4 (1948 prog)	1 (1948 prog)	-
	3 (1974 prog)	1 (1974 prog)	3 (1974 prog)	-	-
	3 (1992 prog)	-	2 (1992 prog)	1 (1992 prog)	1 (1992 prog)
	2 (2000 prog)	1 (2000 prog)	-	1 (2000 prog)	-
	3 (2004 prog)	1 (2004 prog)	1 (2004 prog)	1 (2004 prog)	1 (2004 prog)
	3 (2013 prog)	1 (2013 prog)	1 (2013 prog)	1 (2013 prog)	1 (2013 prog)
8	4 (1926 prog)	-	-	-	-
	2 (1948 prog)	2 (1948 prog)	-	2 (1948 prog)	1 (1948 prog)
	2 (1974 prog)	1 (1974 prog)	1 (1974 prog)	-	-
	2 (1992 prog)	1 (1992 prog)	1 (1992 prog)	2 (1992 prog)	-
	1 (2000 prog)	1 (2000 prog)	3 (2000 prog)	-	-
	3 (2004 prog)	2 (2004 prog)	2 (2004 prog)	1 (2004 prog)	-
	3 (2013 prog)	2 (2013 prog)	2 (2013 prog)	1 (2013 prog)	-

Cognitive Domain of Biology Subjects

When 6th grade biology units' evaluation questions analyzed, results showed that in all programs, knowledge level is the highest. In 1948 program, analysis level is better than other programs. 1948 and 2013 programs has good number of evaluation levels. Analysis of 7th grade biology units' evaluation questions showed that analysis, synthesis and evaluation level is only found in 1926 and 1948 programs. Unfortunately 2013 program is not have enough higher level of cognitive domain based on Bloom's taxonomy. Analysis of 8th grade biology units' evaluation questions showed that 1926 and 1948 programs didn't had biology subjects in 8th grades. Among all 2000 program had better questions based on Bloom's taxonomy. 2013 program has mainly lower level of questions based on Bloom's taxonomy.

Cognitive Domain of Physics Subjects

When 6th grade physics units' evaluation questions analyzed, results showed that 2013 program is better than other programs based on Bloom's taxonomy. Analysis of 7th grade physics units' evaluation questions showed that science textbooks prepared according to 2004 program has less number of higher level questions based on Bloom's taxonomy. Textbooks from 1926 and 1974 programs had all level of cognitive domain. Analysis of 8th grade physics units' evaluation questions showed that 1926 program had all levels of cognitive domain. 1948, 1974 and 2000 programs didn't have synthesis and evaluation levels.

Cognitive Domain of Chemistry Subjects

When 6th grade chemistry units' evaluation questions analyzed, results showed that 1926, 1974, 2004 and 2013 programs had good number of questions in analysis level. Only 1926 and 2013 programs had questions in synthesis level. Analysis of 7th grade chemistry units' evaluation questions showed that 1926 program had questions from all levels. 2013 program didn't have questions from synthesis and evaluation level. Analysis of

8th grade chemistry units' evaluation questions showed that questions prepared to evaluate mostly low level of cognitive domain. 2000 and 1948 programs had more number of questions on analysis level. 2013 program didn't have questions in synthesis and evaluation level

Cognitive Domain of Environment Subjects

When 6th grade environment units' evaluation questions analyzed, results showed that question in 2004 program only prepared in knowledge level. Only questions in 1992 had analysis, synthesis and evaluation level. Number of questions were highest in 1926 program. Analysis of 7th grade environment units' evaluation questions showed that 2000 program didn't have any question in knowledge level. 2000 program had question in analysis, synthesis and evaluation level. 2013 program had more questions in knowledge level than others. Analysis of 8th grade environment units' evaluation questions showed that 1948 and 1992 programs had good number of questions in higher level of cognitive domain. 2004 and 2013 didn't have any question in evaluation level.

Cognitive Domain of Astronomy Subjects

When 6th grade astronomy units' evaluation questions analyzed, results showed that only 1926, 2000 and 2013 programs had astronomy subjects. Questions in 1926 had better cognitive domain level than others. 2013 program only gave knowledge and comprehension level of questions. Analysis of 7th grade astronomy units' evaluation questions showed that only 1992, 2004 and 2013 programs had astronomy subjects. 2004 program had analysis level of questions compared to other programs. 2013 program had questions in synthesis and evaluation level. Analysis of 8th grade astronomy units' evaluation questions showed that only 1948 program had astronomy subject in 8th grade. Questions in analysis level is more than questions in knowledge and comprehensive level

Conclusion

When 6th, 7th and 8th grade science textbooks from seven different program (1926, 1948, 1974, 1992, 2000, 2004 and 2013), results showed that in biology subject, evaluation questions in science textbooks prepared in 1948 program had better in 6th and 7th grades than others. 2000 program had better questions in 8th grade based on Bloom's cognitive domain. In Physics subject, evaluation questions in science textbooks prepared in 2013 program is better in 6th grade compared to other programs. 1926 program is better in 7th and 8th grades based on Bloom's cognitive domain. In chemistry subject, evaluation questions in science textbooks prepared in 2013 program is good for 6th grade, 1926 program is good for 7th grade and 2000 program is good for 8th grade based on Bloom's cognitive domain. In environment subject, evaluation questions in science textbooks prepared in 1992 program is good for 6th and 8th grade, 2000 program is good for 7th grade based on Bloom's cognitive domain. In astronomy subject, evaluation questions in science textbooks prepared in 1926 program is good for 6th grade, 2013 program is good for 7th grade and 1948 program is good for 8th grade based on Bloom's cognitive domain.

Since 2013 program is the newest program we expect that the evaluation questions prepared based on this program has higher level of cognitive domain than other programs. However only evaluation questions in 6th grade physics and chemistry subjects and 7th grade astronomy subject is good. Interestingly evaluation questions in science textbooks prepared based on 1926 and 2000 programs had better based on Bloom's cognitive domain.

References

Baykul, K. (2010). Eğitimde ve Psikolojide Ölçme: Klasik Test Teorisi ve Uygulaması. 2. Baskı. Pegem Yayınları: Ankara

Karip, E. (2011). Ölçme ve Değerlendirme.4. Baskı. Pegem Akademi. Ankara.

Turgut, F.M. & Baykul, Y. (2012). Eğitimde Ölçme ve Değerlendirme, 4. Baskı. Pegem Yayıncılık. Ankara.

Anderson, L.A. & Krathwohl, D.R. (2010). Bloom'un Eğitimin Hedefleri ile İlgili Sınıflamasının Güncelleştirilmiş Biçimi. Pegem Akademi. Ankara.

Arı, A., 2011. Bloom'un Gözden Geçirilmiş Bilişsel Alan Taksonomisinin Türkiye'de ve Uluslararası Alanda Kabul Görme Durumu. Educational Sciences: Theory & Practice, 11(2): 767-772.

Arı, A. (2013). Bilişsel Alan Sınıflamasında Yenilenmiş Bloom, SOLO, Fink, Dettmer Taksonomileri ve Uluslararası Alanda Tanınma Durumları, Uşak Üniversitesi Sosyal Bilimler Dergisi, 6(2), 259-290.

Ayvacı, H. Ş., ve Şahin, Ç. (2009). Fen bilgisi öğretmenlerinin ders sürecinde ve yazılı sınavlarda sordukları soruların bilişsel seviyelerinin karşılaştırılması, Uludağ Üniversitesi Eğitim Fakültesi Dergisi, 22 (2), 441-455.

Başbay, M. (2007). Yenilenmiş Taksonomiye Göre Düzenlenmiş Öğretim Tasarımı Dersinde Projeye Dayalı Öğretimin Öğrenme Ürünlerine Etkisi. Ege Eğitim Dergisi, 8(1).

Bekdemir, M., & Selim, Y. (2008). Revize Edilmiş Bloom Taksonomisi Ve Cebir Öğrenme Alanı Örneğinde Uygulaması Revısed Bloom Taxonomy And Its Apllıcatıon In Algebra Area. Erzincan Eğitim Fakültesi Dergisi Cilt-Sayı: 10-2, 185-196.

Bircan, E. (2012), Türkçe Öğretmeni Adaylarının Hazırladığı Soruların Yeniden Yapılandırılan Bloom Taksonomisine Göre Değerlendirilmesi. Kastamonu Eğitim Dergisi, 20 (3), 965-982.

Çepni, S., Bayrakçeken, S., Yılmaz, A., Yücel, C., Semerci, Ç., Köse, E., Sezgin, F., Demircioğlu, G. & Gündoğdu, G. (2007). Ölçme ve Değerlendirme (1. Baskı). Pegem A Yayıncılık, Ankara.

Demirel, Ö. (2011). Öğretim ilke ve yöntemleri öğretme sanatı. Ankara: Pegem Akademi.

Dindar, H. & Taneri, A. (2011). MEB'in 1968,1992,2000 ve2004 Yıllarında Geliştirdiği Fen programlarının Amaç,Kavram ve Etkinlik Yönünden Karşılaştırılması. Kastamonu Eğitim Dergisi, 2(363-378).

Dindar, H. ve Demir, M. (2006). Beşinci sınıf öğretmenlerinin fen bilgisi dersi sınav sorularının Bloom Taksonomisi'ne göre değerlendirilmesi. Gazi Eğitim Fakültesi, 26, 87 - 96.

Forehand, M. (2010). Bloom's taxonomy. Emerging perspectives on learning, teaching, and technology, 41-47.

Gökler, Z.S.; Aypay, A. ve Arı, A. (2012); İlköğretim İngilizce Dersi Hedefleri Kazanımları SBS Soruları ve Yazılı Sınav Sorularının Yeni Bloom Taksonomisine Göre Değerlendirilmesi. Eğitimde Politika Analizi Dergisi Aralık, 2012, Cilt 1, Sayı, 2, s. 115-133.

Kablan, Z., Baran, T., & Hazer, Ö. (2013). İlköğretim Matematik 6-8 Öğretim Programında Hedeflenen Davranışların Bilişsel Süreçler Açısından İncelenmesi. Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi (KEFAD), 14(1), 347-366.

Köğce, D., & Baki, A. (2009). Matematik Öğretmenlerinin Yazılı Sınav Soruları İle ÖSS Sınavlarında Sorulan Matematik Sorularının Bloom Taksonomisine Göre Karşılaştırılması. Pamukkale Üniversitesi Eğitim Fakültesi Dergisi,26(26), 70-80.

Marzano, R. J., & Kendall, J. S. (Eds.). (2006). The new taxonomy of educational objectives. Corwin Press.

M.E.B. (2000). 2518 Sayılı Tebliğler Dergisi. İstanbul: Milli Eğitim Basımevi.

Pickard, M. J. (2007). The new Bloom's taxonomy: An overview for family and consumer sciences. Journal of Family and Consumer Sciences Education, 25 (1), 45–55.

Riazi, M. A., & Mosalanejad, N. (2010). Evaluation of learning objectives in Iranian high-school and pre-university English textbooks. Teaching English as a Second or Foreign Language, , 1-11..

Tanık, N. ve Saraçoğlu, S. (2011), Fen ve teknoloji dersi yazılı sorularının yenilenmiş Bloom Taksonomisi'ne göre incelenmesi. TUBAV Bilim Dergisi, 4 (4), 235-246.

Yıldırım, A. ve Şimşek, H. (2011). Sosyal bilimlerde nitel araştırma yöntemleri . (8. Baskı). Ankara: Seçkin Yayıncılık. Henry, W. A., III. (1990, April 9). Making the grade in today's schools. *Time*, *135*, 28-31.

Lastname, F. N. (Year). *Title of dissertation*. (Doctoral dissertation). Retrieved from Name of database. (Accession or Order Number)

Lastname, F. N. (Year). *Title of dissertation*. (Unpublished doctoral dissertation). Name of Institution, Location.

O'Neil, J. M., & Egan, J. (1992). Men's and women's gender role journeys: A metaphor for healing, transition, and transformation. In B. R. Wainrib (Ed.), *Gender issues across the life cycle* (pp. 107-123). New York, NY: Springer.

Plath, S. (2000). *The unabridged journals*. K. V. Kukil (Ed.). New York, NY: Anchor.

Schnase, J. L., & Cunnius, E. L. (Eds.). (1995). Proceedings from CSCL '95: *The First International Conference on Computer Support for Collaborative Learning*. Mahwah, NJ: Erlbaum.

Schultz, S. (2005, December 28). Calls made to strengthen state energy policies. *The Country Today,* pp. 1A, 2A.

Scruton, R. (1996). The eclipse of listening. *The New Criterion, 15*(30), 5-13.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 79-95

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

The Effect of Using Active Learning Model on Fourth Year Physics Students' Achievement in the Subjects "Teaching Aids" and "Development of Critical Thinking"

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Abstract: This research aims at identifying the effect of using Active Learning on the achievement of 4th year Physics students in "Teaching Aids" and "Development of Critical Thinking". To bring about these aims, two null hypotheses and 5 secondary hypotheses that follow the second main hypothesis have been set. To validate the hypotheses, a sample (71) male and female 4th year Physics students at the College of Education had been selected and divided into two main groups, namely the experimental group and the control groups with (35) and (36) students in both groups respectively. A process of equivalence was done for both research groups in terms of the variables (Intelligence, Previous Year Achievement in Physics, Age, and Critical Thinking). The experimental group was taught according to the Active Learning Model, while the traditional (ordinary method has been adopted in teaching the control group.The researcher prepared the basic requirements of the research represented by identifying the teaching material and the behavioral objectives behind teaching it. Also lesson plans for teaching both the experimental and the control groups have been set according to the Model of Active Learning and the Ordinary Method, side by side with the provision of the teaching aids and laboratory instrument for applying the experiment.

Keywords: Education development, Education methods, Education methods of physics

Introduction

The research required the availability of two tools. The first was an achievement test in the subject "Teaching Aids" and the researcher prepared it. This comprised of (45) items of the types matching, multiple choice questions and filling in the blanks. The research got both validity and] reliability. Also the Level of Difficulty and Distinction Powers were found for all items of the questionnaire; all of which were within the accepted range of difficulty and distinction. Added to that, the activity of wrong substitutes of the items of Multiple Choice.

The second instrument was the Test of Critical Thinking originally prepared by Al-?alwani (1999). The final version of the test comprised of (75) items distributed among 5 areas to measure the critical mental abilities represented by the skills of inference, evaluating pretexts, identifying assumptions, deduction and interpretation. The researcher found out its validity and reliability.

The experiment was applied from the beginning of the first term during the academic year (2017-2018). The pretest for critical thinking was conducted on the sample of students on (18/10/2017) and the experiment started on the (19/10/2017) for a while studying terms with 3 hours per week so that the total number of lectures came to be (27) hours for each group. The experiment ended after the application of the two instruments (Achievement Test and Critical Thinking Posttest) on (24/10/2017).
The statistical analysis of the collected data by means of the T-test for two independent samples came up with the following:

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

1. There is a significant difference between the achievement means of the two research groups in "Teaching Aids" in favour of the experimental group.

2. There is a significant difference between the means of skill development (inference, deduction, interpretation, and critical thinking a whole) for both research groups in favour of the experimental group.

In the light of the findings of the research, the researcher has come up with a number of conclusions, namely the effectiveness of the Model of Active Learning on the Achievement of 4th year Physics students at the Dept. of Physics in the subjects "Teaching Aids" and "Critical Thinking Development" by the Ordinary Method. The researcher recommended running a training course for male and female teachers of Physics with focus on the use of modern models and strategies in teaching, especially the Model of Active Learning.He also recommended that committees for compiling books of physics should include skill and mental activities that motivate students and enhance their abilities and reinforce their thinking abilities at large and critical thinking inparticular. Finally, the researcher has put forward some suggested topics for future researches.

Problem of the Research

Physics, compared to other sciences, is suffers from misunderstanding, weakness of positive and constructive communication between it and students on one hand, and it and teachers of physics on the other hand. Based on the work of one of the researchers in Physics laboratories, College of Education other/ Dept. of Physics and through the researcher' acquaintance with the researchers and studies related to the teaching of Physics and the difficulties encountered, and also through their repeated visits to many preparatory and secondary schools and eliciting the opinions of many teachers of the subject and others concerned, the researchers found that the difficulty of understanding and learning this subject and the students low achievement in it at large and that of 4^{th} year students in particular are due to many reasons identified by local and international studies and researches. Some of the reasons are related to the methods adopted in teaching Physics, some to students and still some others to teachers. Yet the most prominent reasons remain to be the traditional methods adopted in teaching the subject which had led to the low level of both knowledge and achievement side by side with the limited ability of sound thinking; all of which are highlighted by many studies such as those by Hammash (2004), Al-Khafaji (2008) and (2010).

As such, we can notice the increasing attention to teach this discipline through the educational institutions, and many educational studies and researches have been conducted so as to arrive at a level of understanding and recognition on the part of the learners (Zeghrib, 199: 133). Added to that, the continuous the adoption of the traditional teaching methods has also led to a vivid decrease in the level of students' thinking in general and their critical thinking in particular.

In this respect, Al-harbi points out that the development of students' thinking abilities requires more planning based on thinking of all available alternatives for more utilization and development in the different domains of life. This cannot be available unless the programmes that work to develop the different thinking abilities and skills are adopted. This requires the use of teaching methods and strategies that ally with those programmers so as to activate it and make use of students' latent abilities. The adoption of the traditional teaching methods can negatively affect students' thinking abilities an and skills and create much difficulty in finding solutions for the future problems (Alzarnoofi, 2007: 2).
Since the process of developing students' skills at large and their critical thinking in physics is within the teacher's task through the setting of enhanced learning situations to teach critical thinking. Yet the state of teaching in its traditional form in our educational institutions asserts the existence of a low level of thinking by students in all studying stages and in all domains at large and critical thinking in particular. This has been emphasized by Alkhafaji and AlObaidi (2002), Ameen (2003) and Kerkukli (2008).

There is a possibility to develop students' critical thinking abilities and skills through active learning which feeds the skills of identification and analysis and in turn enable students to develop their self-dependence and not through passive listening (Ibrahim, 2005: 375).

In the light of what has been stated, the researcher has investigated and looked for what can contribute to the solution of the problems pertinent to the teaching of the subject physics (Teaching Aids), the lessening of the difficulties of learning it and limiting their attention to the methods and styles of teaching physics as he thinks that both teaching methods and teaching styles represent one of the effective means to increase achievement and develop critical thinking in this academic subject.

Teaching methods represent one of the effective means to bring about the required changes in the learner's personality and his/her way of thinking. As such, the researcher referred to a developed teaching model that is flexible and suitable to the teaching situation on one hand and their students' learning needs on the other hand. The choice was that of Active Learning Model that contributes to the achievement of a way of teaching that is more effective, removal of learning activities and the promotion of students achievement level and that of their critical thinking in physics. This is due to the fact that this model is a modern one that fits the development arrived at by physics. Added to that, the model has stages where the mental, skills and affective aspects overlap and are enhanced in a way that makes the student the focus of the learning process.

Based on what has been so far stated, the researchers has identified the problem of the research by giving answer to the following question:

What is the effect of the Model of Active Learning on 4th year physics students' achievement in "Teaching Aids" and on the development of their critical thinking?

Value of the Research

What distinguishes the stage we live are the fast and sudden changes. Every day there is more incoming scientific knowledge side by side with more technological applications; all of which has contributed to the solution of the problem that man faces everywhere. It is also affected by their direct and indirect results in the different aspects of his/her life.

Undoubtedly such changes and academic developments affect the teaching process and the present teaching systems have to face this gigantic amount of knowledge, facts and information and has to reconsider times and times the syllabuses, methods of teaching, teaching aids, measurement style and academic activities with an integrated, comprehensive and continuous framework that qualify it to encounter the new and the developed in this changing world (Mazin, 2007: 11).

This requires the doing of basic changesin thestyles and methods of teaching so as to help students acquire an amount of knowledge, skills and attitudes related to the scientific issues and matters and also an amount of the required critical and scientific thinking. Of the disciplines that are related directly to man and his life circumstances is the science of physics which aims at helping man to understand the surrounding natural phenomena and increase his ability to subject them to measurement and estimation and then the man's ability to take benefit from them (AlQuraishi, 2000: 3).

The main reason behind the attention paid to the modern teaching methods is students' learning-teaching needs and the styles used in teaching them and which may be generally inactive. If we can provide beneficial teaching models that may give a chance to teachers to develop different aspectsin their students such as the social, psychological and ethical aspects (Qatami and Qatami, 1998: 12).

There have been several attempts to use and innovate teaching models and strategies which can deal with the explosion in knowledge in physics in terms of ability to organize the amount of concepts, information, relations, theories and roles that the students acquire during studying in such a way that achieves the characteristics of integration, correlation and function. By then the student can use that knowledge to solve the problems he will encounter in his future life.

Among the modern models used in teaching sciences at large and physics in particular is that of (Active Learning) which is based on the constructivist theory. The model was presented by Welly and was then subjected to experimentation on a number of students in the subject of Science, especially the topic "Electricity" to make sure through it that learners' practicing of mental processes according to a strategy (prediction, observation, interpretation) may can contribute to the promotion of the level of their achievement and participation in the classroom, increase cooperation between them and develop their ability to think.

The specialty of the Active Learning Model lies in accommodating basic mental skills that can be developed for learners in the various studying stages and in the subjects that have a link between practical and theoretical sides especially in the science syllabiincluding physics (Teaching Aids).

Prediction is one of the mental skills that subsumes learners' ability to use their previous information or expertise to predict a phenomenon to be studied or an event in the future. This is done in the light of the available information or the partial events pertinent to the phenomenon or the event or the subject of studying. While observation means the intentional and critical attention to phenomena or events so as to uncover the reasons that led to its emergence through the use of the senses (Abdul-Hadi and Ayyad, 2009: 152-153).

Interpretation is a mental skill that aims at adding meaning to the life experiences and deduce a meaning for them. When we put forward an interpretationof an expertise we are but explaining the meaning that is derived from it. And when we ask about the way of arriving at a certain meaning we are but putting forward details that support our interpretation of that expertise (Garwan, 2013: 167).

Since Active Learning Model is a relatively modern model, it has been limitedly tackled. For instance, at the local level, Al-Daini (2001) states that the Active Learning Model has a positive effect on students' achievement in Sciences. Al-Khafaji and Al-Obaidi (2002) showed that the Active Learning Model was effective in developing university students' critical thinking. Also, Al-Obaidi Study (2004) demonstrated the supremacy of the students in the experimental group that was taught according to the Active Learning Method over those in the Control Group which was taught by the traditional method in "Science" of fourth year secondary level. Al-Rubai'i (2007) also states that the girls in the experimental group that was taught by the Active Learning Method achieved better in the field of practical skills than their counterparts in the Control Group that was taught by the traditional method. While Al-Haidari's (2007) study showed that the Active Learning Model has a positive effect on the achievement of first intermediate students in "General Sciences", and that the model was effective in creating mental skills on the part of the pupils.

All this has encouraged the researcher to adopt this model in his research especially if we know that there is no study that has tackled the effect of this model on both achievement and thinking together in "Teaching Aids" taught to fourth year students/ Dept. of Physics.

As such, the use of this model in teaching should be related to the achievements of the objectives behind teaching "sciences"in generaland those behind teaching Physics in particular. Among the important objectives which should be there behind teaching Physics through its varied strategies and models is the development of learners' thinking including all its critical, innovational and scientific dimensions.

Thinking is of different types the most important of which is critical thinking whose teaching and the learning of its skills have been a prime purpose behind the educational policies all over the world and a main objective that all syllabi intend to achieve due to the positive outcomes it has brought about. It has also been proved to have its effects in the life of the individual and the society.

The process of thinking occupies an important status in the educational work and the studying syllabi in all the advanced states worldwide aim at enabling the learner to learn the methods of thinking so as to enable him to adapt with the society wherein he lives and to solve the problems that he encounters in life whether inside the school or outside it. All researchers have proved that failure in developing thinking and its skills represents a main reason behind the emergence of learning difficulties and failure in studying (Ibrahim, 2014: 299).

The main objective behind teaching and learning critical thinking is to improve students' critical thinking which enables them to succeed in all the aspects of their life. It also encourages the spirit of enquiring, researching and questioning, and not to accept facts without investigating or exploring and in such a way that leads to widen students' knowledge horizons, and urges them to set out to wider academic avenues which aims at enriching their knowledge construction and increasing their qualitative learning (Abu Jado and Mohammad, 2012: 225).

Critical thinking as an objective of contemporary education should be developed and its skills should be taught and trained on methods according to suitable teaching methods in spite of the growth and development by the members of the society so as to build and an objective personality and active and participating citizenship in the free society (Mcfarland, 1985: 277).

Fath-Allah (2009) states that critical thinking can be developed in teaching sciences especially Physics by directing students' attention to identify the problems to be solved, to analyze them, to interpret the results, and ask students to carry out activities that require attention and the defiance of mental abilities. And also through directing students' attention to think about their way of thinking and directing it to arrive at the best solutions and to put aside the unsuitable solutions (Fath-Allah, 2009: 91).

It is worthy to note that there are Arabic and foreign studies that deal with critical thinking and developing skills through the use of different teaching models and methods and also its relation with some other variables.

The researcher has seen many studies and taken benefit from them in crystallizing the major points of his research and its orientation. Of these studies are: Kjos and Long (1994) which used the method of problem solving to improve critical thinking, and Al-Alwani's study (1999) which used Klausmeir's strategy and the strategy of contrastive events to learn the concepts of Physics and to develop critical thinking of "Physics". Al-min's study (2003) used two patterns of problem solving to develop the concepts of Physics and critical thinking. Al-Obaidi's study (2005) aimed at identifying students' critical thinking skills. Karkukli's study (2008) used a suggested strategy in teaching mathematics to develop critical thinking. Fath-Allah's study (2009) used thinking maps based on merging to develop achievement and orientation towards cooperative work and critical thinking in "Sciences". Al-Hadeedi's study used the model of knowledge teaching to acquire mathematical concepts and develop critical thinking. There are many other studies. In the light of what has been so far stated, the value of the research can be summarized in the following points:

1. The research tallies with the new orientations in selecting a teaching model and accommodating it in the process of teaching which will duly contribute to the promotion of students' knowledge level and the development of their thinking al large and critical learning in particular.
2. The research derives its value from the importance of critical thinking as it has been a modern urgent need and an essential educational objectives of teaching "Sciences'.
3. It is expected that teaching according to the Active Learning Model will contribute to students' acquisition of a number of basic skills such as telling opinion through prediction and enhancing practical abilities through observation and enhancing mental abilities through explanation in addition to cooperation and taking over responsibility.

The Aim of the Research

The current research aims at identifying the effect of using Active Learning Model on the achievement of 4th year Physics students in the subject "Teaching Aids" and the development of their critical thinking.

The Hypotheses

To bring about the aim of the research, the following two hypotheses have been formulated:

Hypothesis No.1:

There is no significant difference between the mean of the scores of the students in the experimental group which has been taught according to the Active Learning Model and that of the scores of the students in the control group which has been taught according to the traditional model in the achievement test of the subject "Teaching Aids".

Hypothesis No.2:

There is no significant difference between the mean of the scores of the students in the experimental group which has been taught according to the Active Learning Model and that of the scores of the students in the control group which has been taught according to the traditional model in the development of critical thinking.

Limits of the Research

The present research is limited to
1. Fourth Year student/ Dept. of Physics, Open Educational College during the academic year 2015-2016.
2. First studying semester of the academic year 2015-2016.
3. The chapters: first, second and third of the Laboratory Teaching Manual (Teaching Aids) Fourth Year student/ Dept. of Physics during the academic year 2015-2016.

Definition of Basic Terms

First: Model

- Mayer (1995: 687)defines a model as the techniques and methods based on certain learning theories that are designed to arrive at selected teaching objectives.

- Qatami and Qatami (1998: 36) define a model as the strategies used by teachers in the teaching situation so as to achieve teaching outcomes by students according to suppositions on which the Mode is based and within which the role of teacher and students and the style of presentation are identified.

- Al-Zaghlool (2002: 319)states that a model is a full plan and formulation that subsumes the design of a certain content or subject, performing and orienting the process of learning it inside the classroom and evaluating it.

Second: Active Learning Model

- **Welly (1994: 4)** defines Active Learning Model as a teaching model that includes three successive stages: prediction, observation and explanation. It is done by teachers and is worked on within small groups under orientation and counseling on the part of the teacher.

The Operational Definition of Active Learning Model

It is the set of successive procedures required to prepare the teaching plans of the subject "Teaching Aids" for 4th year/ Dept. of Physics according to three mental skills defined in the Active Learning Model, namely prediction, observation and explanation within small cooperative groups.

Third: Achievement

- Good (1973: 7) defines achievement as efficiency in performing a certain skill or a set of acquired knowledge and progress in studying.

- Al-Khaleeli (1997: 6) states that achievement is the result that outlines the students' level and the extent of his progress in learning and what is expected from him to learn.

- Al-Shu'aili and Al-Balooshi (2006: 54) defines achievement as the knowledge, skills and values that the student acquires after going through the teaching experiences and situations that are prepared in advance.

The operational definition of achievement is:

All the knowledge and skills that 4th year students/ Dept. of Physics achieve and the scientific facts, concepts and principles in "Teaching Aids" they acquire due to the preplanned teaching and learning expertise they encounter. Achievement is measured by the score the student gets in the achievement test that is prepared for this purpose.

Fourth: Critical Thinking

It is defined by

- **Paul (1995: 2)** as a unique type of conscious thinking owned by the person who thinks in an organized way and according to clever criteria taking into account methods of thinking and assessing its effect in the light of the objectives.

- Abda (2007: 78) as a series of mental activities and skills carried out by the human's brain when exposed to an irritant received via the senses followed by a process of search for meaning in the different situations.

- Al-Atoom and others (2009: 73) as reflective thinking governed by logic and analysis rules where the individual practices presuppositions, explanation, evaluating discussions and deduction.

- Abo Jado and Mohammed (2012: 231) as personal, evaluative, and reflective thinking that subsumes a set of interrelated knowledge mental processes such as explanation, analysis, evaluation and deduction that aims at examining opinions, beliefs, testimonies, proofs, concepts and claims which are referred to when issuing a judgement or solving a certain problem or making a decision taking into consideration others' viewpoints.

The Operational Definition of Critical Thinking

It is a set of mental skills performed by 4th year students/ Dept. of Physics when exposed to a certain situation or a certain issue of Physics which enable them to judge the things pertinent to a situation or a problem, understanding it, and evaluating it so as to arrive at a suitable solution. These skills include deduction, evaluating pretexts, identifying presupposition, deduction and explanation. It is measured by the score the student gets on the test prepared for that purpose.

Research Procedures

First: Experimental Design

The researcher adopted the experimental design called Equivalent Groups Design with pretest and posttest (Cohen, 2013: 213) as it fits the current research and brings about its aims. This design includes two equivalent groups in a number of variables. The first group, as the experimental group, is taught according to Active Learning Model and the second group, as the control group,is taught by the traditional methods.

Research Population

The research population includes 4th year students at the Open Educational College for the academic year (2015-2016). They are (82) male and female students distributed among 4 groups.

Research Sample

After defining the research population and identifying the studying halls in terms of studying sections. Physics Branch/ Dept. of Sciences/ Open Educational College, 4th year students have been intentionally selected from the research population for the following reasons:
1. The college has Physics laboratories that can be used as fully equipped lecture halls so as to implement the research experiment on the students.
2. The Dept. administration and teachers of Physics in the laboratories showed readiness to cooperate with the researcher and offered the facilities required to conduct the research.
3. The researcher was a member of Dept.'s teaching staff.

Both experimental and control groups were randomly selected. Section (B) was chosen to represent the experimental group which was taught physics according to the Active Learning Method, and section (A) represented the control group material that was taught the same teaching material by the traditional method.

The repeaters in both research groups were statistically excluded due to previous expertise, as outlined in Table (1) below:

Table 1. Number of research sample

Section	Group	Method of Teaching	No. of Students before Exclusion	Number of Repeaters	No. of Students After Exclusion
A	Control	Traditional Method	42	6	36
B	Experimental	Active Learning Model	40	5	35
Total Number of Students			82	11	72

Fourth: Equivalence of Research Groups

For the research to be valid to the level that the difference between the experimental group and the control group can be ascribed to the independent variable and not to other variables or intrusive factors, the researcher conducted a process of equivalence between the research group in variables that can a great effect on the research outcomes, namely (intelligence, previous achievement in General Physics, time age, and Critical Thinking). After calculating the arithmetic means and standard deviations of these variables for both control and experimental groups and then applying T-test for two independent samples, the results are listed in Table (2) below:

Table 2. T-test results for the research groups on the equivalence variable

Variable	**Group**				**Calculated T Value**
	Experimental		**Control**		
	Mean	**SD**	**Mean**	**SD**	
Intelligence	91.8	7.7	90.38	6.525	0.88
Previous Achievement in Physics	61	8.39	59.83	8.443	0.585
Age in Months	222.381	9.342	221.77	9.822	0.268
Previous Critical Thinking	48.4	3.7	47	4.05	1.52

It is clear from Table (2) that the calculated T values for the four equivalence variables are all below the tabulated t values at the adopted significance levels which is (2.000) at the level of Significance (0.05) and the Degree of freedom (69). This means there is no statistically significant difference between the two research groups on these variables. As such, the two groups are equivalent.

Research Requirements

To bring about the aims of the research and validate its hypotheses, the researcher prepared a number of requirements, and as follows:

Identifying the Teaching Material

The teaching material has been identified to include Chapter One, Two and Three of the Prescribed Manual for teaching the subject "Teaching Aids" to 4th year students, Dept. of Physics, and as follows:
- Chapter One: Magnetism.
- Chapter Two: Electricity.
- Chapter Three: Optics.

Formulation of Behavioral Objectives:

Behavioral objectives are an essential basic step in the preparation of any teaching program as they clarify what the learner is supposed to achieve by the end of his/her studying of the scientific content of the program (Al-Khaleeli and Others, 1995: 98).

In the light of the general objectives behind teaching the subject to 4th year students/ Dept. of Physics and depending on the analysis of the teaching materials within the limits if the research, the researcher formulated the behavioral objectives which have been (60) in number according to Bloom's Taxonomy at the levels: Memorization, Understanding, Application and Analysis) respectively. The objectives have been presented to a panel of experts (See Appendix 1) to give their opinion on the formulation of the objectives and to find out the extent of their achievement of the aims behind teaching the subject, the suitability of knowledge levels, and its relation to the teaching material. Some behavioral objectives have been modified in the light of the experts' pinions, and put in their final wording.

Preparation of Teaching Plans

The researcher prepared a set of daily plans to teach both control and experimental groups in the light of the prescribed teaching material and according to some definite teaching steps of the Active Learning Model and the traditional method. A model of teaching plans for each group with the behavioral objectives were presented to a number of experts and specialists in the fields of Physics, education and methods to state their opinions on their fitness and suitability (Appendix 1). In the light of their opinions some modifications were made and they became ready for use. Other teaching plans were prepared in the light of two modified models.

Sixth: Research Tools

Bring about the research aims and verifying its hypotheses required two tools:

First: A pre-test in the subject "Teaching Aids".

Second: A critical thinking test.

Following is clarification of the stages to prepare the two tools:

First: Achievement Test

The current research required preparing an achievement test to measure students' achievement in "Teaching Aids" for both experimental and control groups to identify the effect of Active Learning Model and the traditional method on achievement.

Achievement tests are an organized way to identify students' level in the teaching subject, which is supposed to be learned officially in advance, by giving answers to a sample of questions (items) that represent the content of the teaching subject (Al-Ibadi, 2006: 19).

Accordingly, the researcher prepared an achievement test that goes with the content of the teaching subject and the behavioral objectives that were prepared in advance according to Blooms' Taxonomy in the field of knowledge which includes: memorization, understanding, application and analysis.

A table of properties has been prepared in the light of the behavioral objectives. The number of the items of the test in its initial formulation was (45) items derived from objective tests (Multiple-Choice tests, Matching and Filling in the Blanks). Such tests are usually comprehensive, easily conducted, of low cost, economic in terms of the efforts exerted on correction (Samara and Others, 1989: 65). Concerning the distribution of the test items amongthe four knowledge levels, see Table (3):

Table 3. Distribution of the test items among the four knowledge levels

Knowledge Level	Items No.	Number
Memorization	1, 3, 4, 12, 14, 15, 17, 20, 23, 29, 30, 31, 32, 35, 36, 40, 42	17
Understanding	5, 6, 9, 10, 16, 18, 19, 24, 27, 28, 33, 39, 41, 44, 45	15
Application	7, 8, 11, 22, 26, 34, 38	7
Analysis	2, 13, 21, 25, 37, 43	9

Test Validity

Test validity means that a test measures what it has been set to measure. That is to say, a valid test measures the function it aims to measure and does not measure anything else instead of or added to that (Mulhim, 2000: 272).

To prove test validity, the test in its primary form with a list of behavioral objectives and the prescribed manual of "Teaching Aids" in addition to the table of properties were given to a group of experts and specialists in the fields of Evaluation and Measurement, Methods of teaching Physics and Sciences, and teachers of Physics (Appendix 1). The percentage (80%) and above of agreement has been adopted as a criterion for accepting the item.

In the light of the notes by the group of experts and specialists, all the items got this percentage and more, in addition to the modification made to some items in terms of formulation, content of Physics, and the addition of some diagrams for clarification. As such, both face validity and content validity of the test have been proved.

The Pilot Experiment of the Test:

To approve the psychometric properties of the test items and know the clarity of the instructions as well as calculating the time students needed to answer the test, the test was administered to a pilot sample of (50) male and female 4th year students/ Dept. of Physics/ College of Science. It was evident from the test that the instructions were clear and the time required to answer all the items was (70) minutes; the time the last student needed to leave the test hall. After scoring the answers, the results were statistically analyzed to find out the difficulty factor, the distinction factor, and wrong alternatives activity. In the light of that, the test was put in its final version subsuming three sets of items according to the way they were supposed to be answered. They were:
- The first set includes (10) items of the matching type.
- The second set includes (25) items of the Multiple Choice type.
- The third group includes (10) items of Filling in the Blanks type.

Test Reliability

Reliability means agreement or alignment in results (Marshal, 1972: 104). The reliable test is that which measure a phenomenon with an acceptable level of accuracy (Awda, 1993: 335).Kuder-Richardson -20 Equation has been adopted to measure the reliability of the test as it fits this type of tests (Mulhim, 2000: 265). Reliability coefficient of the test was (0.92). This means that the test was characterized by a high reliability and stability degree and could be depended upon. Accordingly, the final version of the test included three sets of items according to the way to be answered. They were:
- The first set includes (10) items of the matching type.
- The second set includes (25) items of the Multiple Choice type.
- The third group includes (10) items of Filling in the Blanks type.

Second: Critical Thinking Test

Since one of the aims of the research is to identify the effect of Active Learning Model on Developing the critical thinking of 4th year students/ Dept. of Physics, this required the adoption of a test of critical thinking. The researcher got access to a number of studies and tests specifically related to the critical thinking of students at different studying levels. After discussions with some teachers of long expertise and experience in teaching, the two researchers adopted, as a research tool, the test prepared by Al-Alwani (1999) as it serves the objectives of the research and suits the research population. This is so because the items are but situations and questions of physics pertinent to what the student has studied in the subject "Physics" and the scientific experiences he has gone through during the previous period of his studying.

The construction of the test was based on Watson and Glassier's Test on critical thinking which subsumes five areas to measure the critical mental abilities represented by the following skills:
1. Deduction: Includes 5 situations and 18 items.
2. Evaluating Pretexts: Includes 5 situations and 15 items.
3. Identifying Suppositions: Includes 3 situations and 12 items.

4. Induction: Includes 5 situations and 15 items.
5. Explanation: Includes 5 situations and 15 items.
Accordingly, there are 23 situations and 5 items.

Test Validity

To bring about test validity, it was given to a group of experts and specialists in the fields of Evaluation and Measurement, Methods of teaching Physics and educational psychology (Appendix 1). The percentage (80%) and above of agreement has been adopted as a criterion for accepting the item. By so doing, the face validity of the test was proved.

Test Reliability

Kuder-Richardson -20 Equation (K-R- 20) has been adopted to measure the reliability of the test after applying it to a pilot sample of (60) male and female 4^{th} year students/ Dept. of Physics/ College of Science. Reliability coefficient of the test was (0.92). This means that the test was characterized by a high reliability and stability degree. Samara and Others (1989: 120) see that if reliability reaches (0.75), it is regarded a high reliability.

Clarity of Instructions and Calculating the Time of Answering:

From the answers of the pilot sample, it was evident that the test instructions were clear the students. The time spent on answering all the items was (60) minutes, It was the time spent by the last student needed to leave the test hall.

The Final version of the Test

After insuring both validity and reliability, the test of Critical Thinking was ready for implementation in its final form:

Seventh: Correction of research Tools

Both research tools were corrected in the following way:

The Achievement Test

Since the achievement test is an objective test of the types matching, multiple choice and filling in the blanks, the researcher put a key to score the items of the test when the score (1) was given to the correct answer and (0) to the wrong or neglected answer or the one that was marked by more than one alternative. As such, the score of the achievement test ranged from (0) zero to (45) marks.

Critical Thinking Test

The researcher put a key to score the items of the test when the score (1) was given to the correct answer and (0) to the wrong or neglected answer or the one that was marked by more than one alternative. As such, the score of the achievement test ranged from (0) zero to (75) marks.

Eighth: Procedures of the Safety of Experimental Design

The researcher proved the internal and external safety of the experimental design by controlling its effects.

Ninth: Procedures to Implement the Experiment

After choosing the research sample and dividing it into two equivalent groups (Experimental and Control) on a number of variables in addition to the preparation of the two tools and the set of teaching programmers according to the Active Learning Model and the Traditional method and insuring both internal and external safety in terms of a number of variables, the researcher started executing the experiment from its first day. They adopted the steps and procedures to carry out the class for both experimental and the control groups, and as follows:

The Experimental Group

The students in this group were taught according to the Active Learning Model, and as follows:
At the beginning, the researcher distributed the students inside the classroom or the laboratory in the form of randomly selected groups of (4-5) students of heterogeneous achievement. Then for each group, the required tools for work and an agenda that includes certain instructions and questions were prepared.

After that, a short introduction about the prescribed teaching subject and some motivating questions were posed in front of the students either orally or written on the board. Finally, the teacher moved to the presentation of the teaching material according to the Active Learning Model which includes the following three stages (previously explained):
1. Prediction.
2. Observation
3. Explanation.

The Control Group

Students in this group were taught according to the traditional method and as follows:
1. Writing the main subtopics of the prescribed teaching subject on the board.
2. Giving an introduction to the new lesson by relating it to the previous lesson by posing a set of review questions or based on direct explanation.
3. Explaining the teaching material through examples, definitions, or diagrams available in the manual and focusing on some important and prominent points with some questions directed to students and doing some simple experiments in front of them if required.
4. Finally, the lesson is summarized in the form of points on the board. Students are asked to jot them down in their notebooks. Finally, students are asked some evaluative questions.

Tenth: Statistical Means

The following statistical means have been used:
1. Level of Items Difficulty to find out the level of the difficulty of the achievement test items (Al-Abai, 2006: 96).
2. Distinctive Power of Items to find out the distinctive power of the achievement test items(Ibrahim and Others, 1989: 78).
3. The Effectiveness of Wrong Alternatives to find out the wrong alternatives of the achievement test items from the Multiple Choice type (Al-Dhahir and Others, 1999: 91).
4. Kuder-Richardson-20 to find out the reliability of both achievement and critical thinking tests (Ferguson, 1981: 243).
5. T-Test for two independent samples to bring about equivalence between the two research groups (Al-Baldawi 2004: 227).

Discussion of Results

First: Results Related to the First Hypothesis which states:

"There is no significant difference between the mean of the experimental group students' scores who are taught according to the Active Learning Method and that of the control group students who are taught according to the traditional method in terms of their achievement in the subject "Teaching Aids".
To validate this hypothesis, t-test for two independent samples has been used. After analyzing the data, the results demonstrated in Table (4) below have been arrived at:

Table (4) T-test results of the mean scores of the experimental and control groups on the achievement test

Group	No.	Arithmetic Mean	Variance	Degree of Freedom	Calculated t-test
Experimental	**35**	**34.8**	**18.517**	**69**	**4.49***
Control	**36**	**29.8**	**25.418**		

- **p>0.001**

It is evident from table (4) that the calculated t value is (4.49). comparing this with the tabulated t value (2, 2.65, 3.44) at the levels of significance (0.05, 0.01, 0.001) successively and 69 Degree of Freedom, the calculated t value is larger than the tabulated t value at the lowest level of significance, that is (0.001).

As such, the first null hypothesis is rejected this indicates that there is a statistically significant differencebetween the two groups in achievement in favour of the experimental group which was taught according to the Active Learning Model. This result is in agreement with that of Welly (1994), Al-Rubai'i (2007), and Al-Haidari (2007).

The researcher ascribe that to the technique that characterizes the Active Learning Model according to its three stages (Prediction, observation and explanation) which makes students compete among themselves in their groups and be eager to know the results of what they have predicted through their observation of what was going on while they were doing the practical experiments and activities pertinent to the teaching subject. The students' enjoyment of competition and eagerness to learn reach their climax when students explain what they observed practically by relating it to the situation they are living and then recognizing the meaning, i.e. for them, learning becomes meaningful. As a result, the student becomes more interactive with the requirements of the teaching subject, the way the class is going on, and understands his teacher better, and assimilates the teaching method represented by the Active Learning Model.

Added to that, the independence of each step of this model by itself, its clarity and correlation with each other lead to the integration of the knowledge image for the students in the experimental group. This is represented by their ability to solve problems in physics in a scientific way at the level of the syllabus or outside it,And it been positively reflected on their achievement in "Teaching Aids". Also, the integration that takes place in this model in both practical and theoretical parts, the fixedness of the things observed through experimenting and jotting down and explaining the results arrived at, all enhance the retention of information and the correction of the wrong concepts in students' minds as it is due to understanding and assimilation and not mere superficial knowledge.

Second: Results Related to the Second Hypothesis

The second hypothesis states:

"There is no significant difference between the mean of the experimental group students' scores who are taught according to the Active Learning Method and that of the control group students who are taught according to the traditional method in terms of the development of critical thinking".

To validate this hypothesis, t-test for two independent samples has been used. After analyzing the data, the results demonstrated in Table (5) below have been arrived at:

Table (5) T-test results of the mean scores of the experimental and control groups on the critical thinking test

Group	No.	Arithmetic Mean	Variance	Degree of Freedom	Calculated t-test
Experimental	**35**	**5.57**	**19.878**	**69**	**4.3***
Control	**36**	**0.944**	**12.682**		

- **p>0.001**

It is evident from table (4) that the calculated t value is (4.3). comparing this with the tabulated t value (2, 2.65, 3.44) at the levels of significance (0.05, 0.01, 0.001) successively and 69 Degree of Freedom, the calculated t value is larger than the tabulated t value at the lowest level of significance, that is (0.001), As such, the second null hypothesis is rejected this indicates that there is a statistically significant difference between the two groups in critical thinking in favour of the experimental group which was taught according to the Active Learning Model. This result is in agreement with that of Al-khafaji and Al-Obaidi(2002), Amin (2003), Karkukli (2008), Fath-Allah (2009) and Al-Hadidi(2009).

The researcher ascribe that to the effectiveness of the Active Learning Model according in accommodating several teaching styles to enhance critical thinking skills. Examples of these teaching styles are cooperative learning in groups, side conversations, learning through question raising, brain storming, comparisons, identification of properties and characteristics, inquiring about the available clues to support the occurrence of a certain outcome, thinking of the value of outcomes and critical and careful judgment on results. All of this has helped students to express their ideas, reflecting on and modifying them, which has in turn led to the development of critical thinking in a positive and an ongoing way.

Added to that, the stages of Active Learning Model have aspects that enhance critical thinking skills and the tools that these skills require which are related to the understanding of the phenomena, logical analysis of things and the ability to take decision in a reasonable way far from extreme fanaticism towards other pinions. Prediction, observation and explanation interrelate and participate with the students' critical thinking skillsin such a way that leads to the promotion of the development level of those skills and this type of thinking.

Conclusions, Recommendations and Suggestions

First: Conclusions

In the light of the results arrived at, the researcher conclude that:
1. The effectiveness of the Active Learning Model on 4th year students/ Dept. of Physics achievement in the subject "Teaching Aids" and the development of their critical thinking compared to the traditional method.
2. The possibility of applying the Active Learning Model in teaching the subject "Teaching Aids" to 4th year students/ Dept. of Physics.
3. Dividing students taught according to this model into cooperative groups of definite functions has contributed to their motivation and interaction with the way the class was going on. It has made the class more active and interesting. This has been positively reflected on the outcomes.

Second: Recommendations

In the light of what has been stated, the researcher recommend:
1. Running training courses by the Directorate of Training / The General Directorate of Education for teachers of Physics at the Preparatory Level to train them on using the modern teaching models and strategies including Active Learning Model.
2. The authorities in charge have to prepare a suitable teaching environment and provide the teaching aids and devices needed in teaching physics at the educational institutions so as to facilitate the application of the modern teaching models in general and Active Learning Model in particular as it requires mixing between the practical and theoretical aspects while teaching.
3. The committees in charge of compiling textbooks at the Ministry of Education have to include in the textbooks of Physics mental and skill activities to train students on practicing thinking skills at large and critical thinking in particular.
4. The same committees have to attach a practical manual including the suggested experiments to be carried out, the purposes behind them, and the materials and devices to the physics textbooks so as to train students to do experiments and to increase their living of the practical situation of Physics.

Three: Suggestions

To make the results of the current research more comprehensive and complete, the researcher suggest the following:

1. Carrying out a study similar to the current one on other studying stages and on other teaching subjects.
2. Carrying out a study similar to the current one on schools and other educational institutions.
3. Carrying out a study similar to the current one taking into account other dependent variables such as academic thinking, innovative thinking, motivation, change of conceptions in Physics, Attitudes towards Physics andanalyzingthe Physical meaning.

References

Ibrahim, ahid and Others (1989). Principles of Evaluation and Measurement in Education. 1st ed. Jordan, Amman: Amman House for Publishing and Distribution.

Ibrahim, Majdi Aziz (2014).Thinking from and Educational Perspective: Definition, Nature, Skills, Development and Types. 3rd ed. Cairo: AalamAlkutub for Publishing, Distribution and Printing.

Abu Jado, Salih Mohammed and Mohammed BakirNawfal (2012). Teaching Thinking: Theory and Practice. 3rd ed. Jordan, Amman: Dar Al-Maseera for Publishing, Distribution and Printing.

Amin, Ahmed Jawhar Mohammed (2003). The Effect of Using Two Types of Problem Solving to Develop Concepts of Physics and Critical Thinking by Students at the Dept. of Physics. (Unpublished Ph. D. thesis), College of Education, University of Mosul.

Al-Baldawi, AbdulhameedAbdulmajeed (2004). Styles of Scientific Research and Statistical Analysis. 1st ed. Jordan, Amman: Dar Alshurooq for Publishing and Distribution.

Jarwan, Fathi Abdul-Rahman (2013). Teaching Thinking: Concepts and Applications. 5th ed. Jordan, Amman: Dar Al-Fikr for Publishing and Distribution.

Al-Hadeedo, Ahmed ObaidAwayid (2009). The Impact of Using Knowledge Teaching on 5th Year Scientific Students' Acquisition of Mathematical Concepts and Development of Critical Thinking. (Unpublished M. ed. Thesis), College of Education, University of Mosul.

Hammash, ZiyadTaha. (2004). Obstacles of Teaching Physics at the Preparatory Stage from the Viewpoints the Teachers' of the Subject in Salahuuddin Governorate. (Unpublished M. ed. Thesis). College of Education/ Ibn Al-Haitham, University of Baghdad.

Al-Haidari, Mohammed Rahim Hafith (2007). The Impact of a Teaching/Learning Model on 1st Year Intermediate Pupils' Achievement in General Sciences and the Development of their Mental Skills.(Unpublished M. ed. Thesis). College of Education/ Ibn Al-Haitham, University of Baghdad.

AlKhafaji, HaidarMuhsinSarheed (2008). Constructing A Teaching-Learning Programme in Physics and Its Effect on Pupils Achievement and Attitudes towards the Subject. (Unpublished M. ed. Thesis). College of Education/ Ibnn Al-Haitham, University of Baghdad.

Al-Khafaji, TalibMahmood and AshwaqNissayif Al-Obaidi (2002). The Impact of using A Teaching/Learning Model on Developing University Students Critical Thinking. Proceedings of the Researches of the 15th Scientific Conference, College of Education, AlMustansiriyya University.

Al-Khalili, Khalil Yousif and Others (1995). General Science Syllabuses and the Styles to Teach Them. 1st ed. Republic of Yemen, Sanaa', Ministry of Education, Rehabilitation and Training Sector.

Al-Khalili, Khalil Yousif (1997). Preparatory Pupils' Academic Achievement. Bahrain, Manama: Ministry of Education.

Al-Daini, BatoolMohammed (2001), The Impact of Teaching according to a Suggested Model on 5th year Primary Pupils in General Science. (Unpublished M. Ed. Thesis), College of Teachers, University of Diyala.

Al-Rubai'i, NajlaMahmood Hussein (2007). The Impact of Using the Models of Shape Map (V) on the Achievement of Female Students at the Teachers' Training Institute and their Practical Skills in General Science. (Unpublished Ph.D. Thesis), University of Baghdad, College of Education/ Ibn Al-Hautham.

Al-Zarqooni, Nada BintNaji (2007). The Effect of Using the Computer on Developing Innovative Thinking and Achievement in Physics by 2nd Year Secondary Female Pupils. (Unpublished M. A. thesis), Um Al-Qura University, College of Education.

Zaghrib, Abdul-Rahman (1990), The Role of Laboratories in Teaching Physics, Journal of the Union of Arab Universities, Amman,Vol. (5), pp. 132-138.

Al-Zaghlool, Imad Abdul-Raheem (2002), Principles of Educaional Psychology, 2nd ed. UAE, Al-?ain: Dar Al-Kitab Al-Jami'i.

Sulaiman, Ali Salim (2010). The Impact of Bolya and AlSamaadi Strategies on Solving Physics Problems in the Achievement of 5th Preparatory Female Pupils and Developing their Motivation to Learn Physics. (Unpublished M. Ed. Thesis), University of Mosul, College of Education.

Samaara and Others (1989).Principles of Educational Measurement in Education. Jordan, Amman: Dar Al-Fikr for Publishing and Distribution.

Al-Shu'aili, Huwaishil ad Mohammed Bn Ali Al-Balooshi (2006). An Analytical Study of the Educational Factors That Reduce the Achievement of Students of General Certificate in Physics from Teachers and Supervisors' Viewpoint. The Journal of the Union of Arab Universities for Education and Psychology, Vol. (4), No. (2), pp.45-91.

Al-Dhahir, Zakariya Mohammed and Others (1999). Principles of Evaluation and Measurement in Education. 1st ed. Jordan, Amman: Dar Al-Thaqafa for Publishing and Distribution.

Al-Abaadi, Ra'id Khalil (2006). School Tests. 1st ed. Jordan, Amman: Al-Mujtama' AlArabi Bookshop for Publishing and Distribution.

Abda, Abdul-Mu'min Mohammed (2007).Modern Orientations in Developing Positive Critical Thinking through the Teaching of History in the General Certificate.Risalat Al-Tarbiya Journal. No. (15), pp.76-94. Oman Sultunate,

Abdul-Hadi, Nabeel and Waleed ?ayyad (2009). Strategies to Learn Thinking Skills between Theory and Practice. 1st ed. Jordan, Amman: Dar Wa'il for Publishing and Distribution.

Al-Obaidi, Ahmed Abdul-RahmanKhudhayir (2004). The Impact of Using Active Learning Model on 4th Year Secondary Pupils' Achievement in the Subject"General Sciences", (Unpublished M. Ed. Thesis), University of Diyala, College of Education.

Al-Obaidi, Sa'eedMosaAlwaan (2005). Gifted Pupils' Critical Thinking Skills in Mathematics. (Unpublished M. Ed. Thesis), University of Baghdad, College of Education/ IbnRushd.

Al-Atoom, Adnan Yousif and Others (2009). Developing Thinking Skills: Theoretical Models and Practical Applications. 2nd ed. Jordan, Amman: Dar Al-Maseera for Publishing, Distribution and Printing.

Al-Alwani, Muhhand Sami (1999). The Effect of Using Klausmeir's and Contrastive events Strategies Models on Learning Physics Concepts and Developing Critical Thinking.(Unpublished Ph. D. Thesis), University of Baghdad: College of Education/ Ibn Al-Haitham.

Awda, Ahmed Sulaiman (1993). Evaluation and Measurement in the Teaching Process. 3rd ed. Jordan, Amman, Dar Al-Amal for Publishing and Distribution.

Fath-Allah, MandoorAbdul-Salam (2009). The Impact of the Strategy of Thinking Maps Based on Merging on Developing Saudi Intermediate Pupils' Achievement in Sciences and Their Critical Thinking and Attitudes towards Cooperative Work. Risalat Al-Khaleej Al-Arabi, Year (30), No. (111), pp.61-109.

Al-Quraishi, Mahdi AlwanAbbood (2000). The Impact of Using Three Strategies in Teaching Physics Concepts on 4th Year Secondary Pupils Academic Orientations, Achievement and (Unpublished Ph.D. Thesis), University of Baghdad, College of EducationLIbn Al-Haitham.

Qatami, Yousif and NayifaQatami (1998). Models of Classroom Teaching. 2nd ed. Jordan, Amman: Dar Al-Shurooq for Publishing and Distribution.

Karkookly, Abdullah Mahmood (2008). The Impactof A Suggested Strategy to Teach Mathematics According to the Constructivist Theory on 4th Year secondary Pupils' Critical Thinking.(Unpublished M.Ed. Thesis), University of Mosul, College of Education.

Mazin, Husam Mohammed (2007). New Orientations in teaching and Learning Sciences. 1st ed. Cairo: Dar Al-Fajr for Publishing and Distribution.

Mulhim, Sami Mohammed (2000). Evaluation and Measurement in Education and Psychology. 1st ed. Jordan, Amman: Dar Al-Maseera for Publishing and Distribution.

Al-Najdi, Ahmed and Others (1999). Introduction to the Teaching of Science. Cairo: Dar Al-Fikr Al-Arabi.

Al-Najim, FayyathAbdullatif and Others (2008). Physics for 5th Year Scientific, 15th ed. Republic of Iraq, Baghdad: Ministry of Education.

English References

Cohen, L. M. and Morrison, K. (2013). Research Methods in Education. New York: Rutledge Flamer.

Ferguson, George A. (1981). Statistical Analysis in Psychology and Education. 5th ed. London: McGraw-Hill.

Good, G. V. (1973). Dictionary of Education. 3rd ed. New York: McGraw-Hill Company.

Marshal, John. (1972). Essentials of Testing. California: Addison Wesley Publishing Company.

Mayers, C. H.(1995). The Professional Education; A New Introduction to Teaching and School. Belmont: Wardsworth Publishing Company.

McFarlan, Mary (1985).Critical Thinking in Elementary School. Social Education, Vol. (49), No. (3).

Paul, R. (1995). Critical Thinking, How to Prepare Students for a Rapidly Changing World. USA, California, Santa Rosa: Foundation for Critical Thinking.

Welly, R. (1994). A Close-up at How Children Learn Science.Educational Leadership, Vol. (51), No. (5), pp. 33-35.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 96-103

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Investigation on Environmental Awareness Level of Teachers

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Abstract: The purpose of this study is to determine the environmental knowledge, attitudes towards the environment and environmentally friendly behaviors, i.e., the level of environmental awareness of in-service teachers and to understand whether certain variables such as major, gender, duration of experience affects these issues. The study was carried out in 2016-2017 academic year with 302 voluntary teachers who are in different education stages and majors in the city of Etimesgut in Ankara. In addition, the area of the study, represents the regions of Turkey where citizens are from different socioeconomic levels. In this regard, this study will be instrumental in having a general idea of the teachers in Ankara. Data were collected with a quantitative scale called "Environmental Awareness Scale". The scale starts with a section consisting of 13 questions which are about demographic information of participants and the environment. The scale consists of 3 chapters which each of them contain 20 questions to measure knowledge, attitude and behavior towards the environment. Analysis of the data was performed with SPSS 22.0; frequency, percentage, mean, standard deviation values, t test, analysis of variance (ANOVA) and correlation analyzes were applied. With the aim of testing the reliability, Co. Alpha analysis was applied, as a result Co. Alpha coefficient was found to be 0.98. In addition, factor analysis was performed with the aim of testing the construct validity of the scale. According to the research findings, participants' genders were found to have an effect on attitude and knowledge levels but not on their behaviors. The attitudes towards the environment of those who are interested in plants and animals in their childhood have been positively influenced. Moreover, it has been observed that attitude and knowledge do not have a positive effect on behavior alone but knowledge and attitude have a positive effect on each other.

Keywords: Environmental education, Environmental awareness, Environmental knowledge, Environmentally friendly behavior

Introduction

The environment is a place in which living and non-living factors coexist in harmony and congruity (Erten, 2000). From the early ages to the present, the relationship with the environment of the human being varied day by day; nutrition, needs for marriage have been evolved, the trail left to nature has been increasing with every new technological development.

New ways of life, daily routines and unsustainable habits of today's people, are increasingly damaging the right to life of future generations and leading to the destruction of the livable world heritage (O'Gorman & Davis, 2012). Improving the relationship with the environment of the person who is a part of the environment and changing the course of this negative scene can only be made possible through education. With an effective environmental education that will appeal to every segment of the society, the individual will take part in the solution of environmental problems as well as prevent the emergence of new problems from the root (Tanrıverdi, 2009).

The main objective of the countries' forming an education system is to ensure that individuals become conscious consumers, productive and responsible citizens, with the development of their academic competences at the end of the training period (Hungerford & Volk 1990).

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

The main objective of the countries' forming an education system is to ensure that individuals become conscious consumers, productive and responsible citizens, with the development of their academic competences at the end of the training period (Hungerford & Volk 1990). With effective environmental education, environmentally friendly individuals who have high environmental awareness will grow up so that strong steps can be taken to overcome environmental problems. It is expected that individuals who receive environmental education should have the knowledge and right attitude and behavior towards the environment namely environment literacy about how human activities affects the nature (Teksöz, Şahin and Ertepınar, 2010).

The environmental problems that are on the agenda of the world have become a concern for everyone. From the beginning of the 70s, state administrators met with scientists and brought these problems and their results to the agenda (Ünal ve Dımışkı, 1999). The Tbilisi Declaration, which was published in 1977, defined environmental education and expressed its aims. After this declaration, it is elaborated on how to reach the aims stated in all environmental education studies (Gökçe et al., 2007). For an effective environmental education, teachers need to have a high level of environmental knowledge, environmental attitude and environmentally friendly behavior. According to Ertürk (1970), the influence of teacher behavior on students' learning is becoming increasingly important.

When the literature is examined, it is seen that the studies related to environmental education are mostly carried out with the students and the studies about the teachers are few in number. Environmentally friendly behavior, which is the most important indicator of environmental awareness, has not been taken into consideration in most studies. The aim of this study is to determine environmental knowledge, environmental attitude, environmentally friendly behaviors and environmental awareness of in-service teachers and to determine whether they have an effect on certain variables such as major, gender, duration of experience.

Environmental Awareness

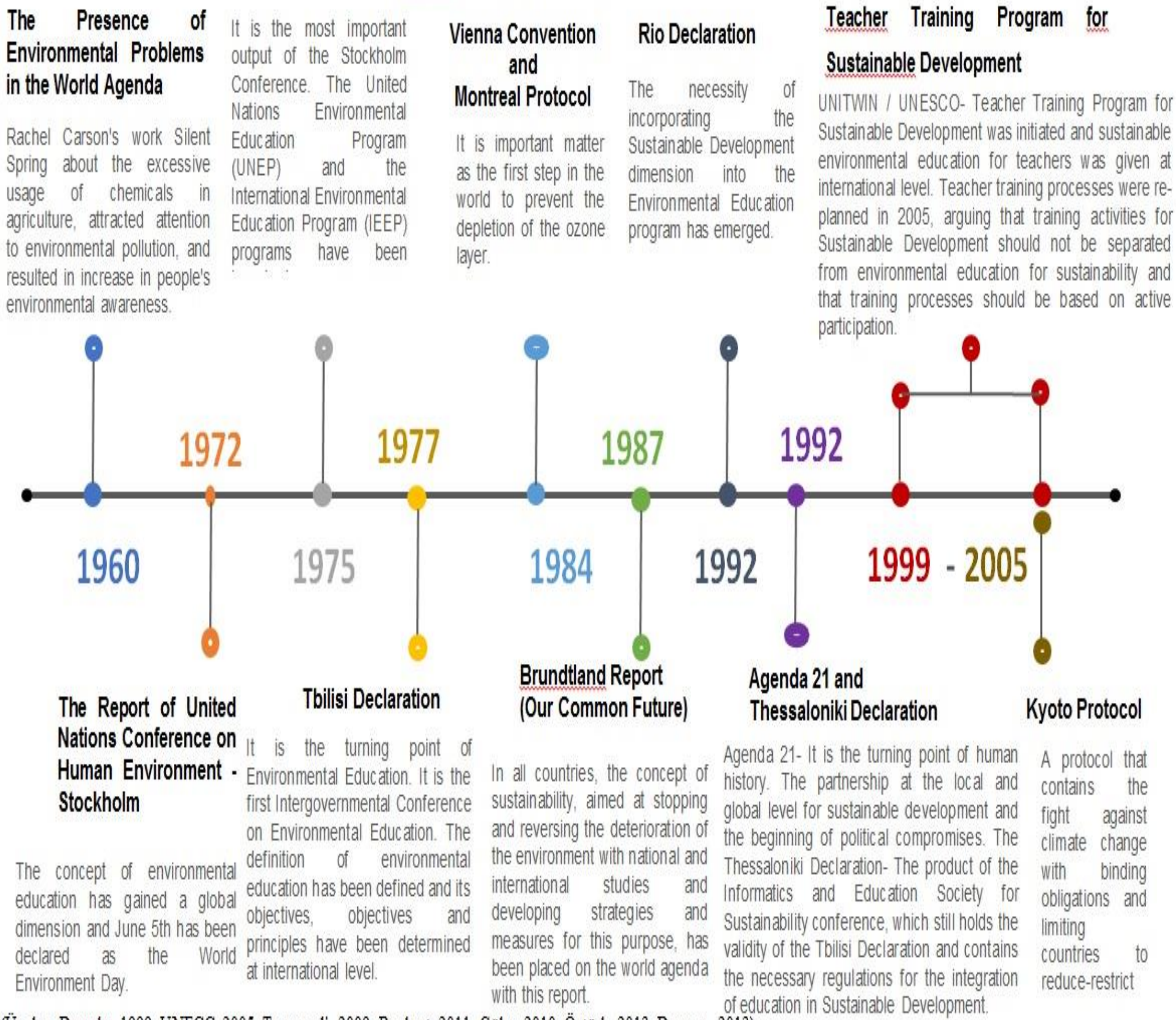
Environmental awareness is a product which arises from environmental information, positive attitudes towards the environment and environmentally friendly behaviors influencing each other (Erten, 2000). In the Declaration of Tiflis, the awareness classified within the aims of environmental education is defined as the individuals and societies gaining sensitivity of to all environment and its problems (Ünal et al., 2001). Individuals with high awareness of the environment will know themselves and their environment in all aspects, will first be responsible for the environment and other living things, and will act with the understanding of the wholeness of the environment rather than the sense of environment for people. A high society with environmentally friendly behavior and environmental awareness can only be achieved through qualified education. Ertürk (1988) describes education as "the process of bringing change in the behavior of the individual through his or her own experience and intention". The influence of the teachers is incomprehensible in bringing this behavior change to the individual and consequently the emergence of a high environmental awareness. For this reason, the fact that teachers have a high level of environmental awareness is an important influence that will accelerate the process.

Environmental Education and Its History

Environmental education is a training based on nature conservation, integrating with the ecology about the functioning of the environment and providing the theoretical information, as well as educating the environment volunteers by encouraging positive emotions towards the environment (Ünal et al., 2001). According to Davis (1998), environmental education is not an academic course but an education that shapes the individual's positive perceptions of the environment and ultimately leads to eco-friendly behavior.

When the historical development of environmental education is examined, it is seen that it coincides with the emergence of environmental problems. Environmental education could not create the necessary effect in the environmentally aware higher societies, despite the fact that it has received wide repercussions all over the world and has been present for a long time (Travis, 2007). In a study that examines the failure of environmental education, it is stated that although the environmental sensitivities of the individuals are high, they cannot understand the underlying causes of the environmental problems and that the education given should provide individuals the ability to solve the problems and to take place in the center of organized education (Gigliotti, 1990).

Figure 1. The history of environmental education



(Ünal ve Dımışkı, 1999; UNFCC, 2005; Tanrıverdi, 2009; Bozkurt, 2011; Güler, 2010; Öztürk, 2013; Derman, 2013)

Method

Universe and Sampling

The universe of the research is teachers working in Ankara. The size of the universe, easily accessible sampling method is preferred due to the researcher's difficulty of access, is limited to the city of Etimesgut, one of the largest and most populous district of Ankara. The study was carried out in 2016-2017 school year with the participation of 302 teachers from 25 different schools, ranging from kindergarten to vocational high school, selected from regions representing the district in terms of different socioeconomic levels.

In the study, the environmental awareness level of the teachers was tried to be determined by using the "Environmental Consciousness Scale" developed by Erten (2005). At the beginning of the scale, the demographic characteristics of participants (settlement, area, seniority) and the independent variables of the study are included. These questions are personal questions that will be used to describe participants' environmental awareness levels.

In the Environmental Awareness Scale, there are 60 questions in total, 20 question per subjects; the surrounding area, attitudes towards the environment and environmentally friendly behavior. The proposals in all the items in the measurement are scaled from negative to positive by 5 point likert scale. The items in the scale were used by many researchers in the country and abroad. (Erten, 2005, 2012, Schrenk, 1994, Öztürk, 2013)

Reliability and Validity

The Cronbach α reliability analysis was applied with the aim of testing the reliability of the Environmentally Conscious Scale and the Cronbach α coefficient was found to be 0,98. Factor analysis was used to determine the construct validity of the scale. In addition, the Kaiser-Meyer-Olkin Sample Compliance Measure (KMO) was used to determine if the size of the study group was sufficient. In the factor analysis, the KMO sampling adequacy coefficient was found to be 0,98. According to Büyüköztürk (2004), the coefficient value of 0,98 indicates that the study group is of sufficient size due to both being above the critical value (0,70) and close to 1. As a result of factor analysis, the three sub-dimensions obtained constitute approximately 93% of the total variance.

Table 1. The reliability and validity of the environmental awareness scale

Lower Scale (Size)	**Explained Variance**	**Inner Consistency**	**KMO**
Information	17%	0,84	0,98
Attitude	41%	0,91	
Behavior	35%	0,87	

Analysis of Data

In the analysis of the data, SPSS 22.0 package program was used. Descriptive statistics, frequency, percent, mean, standard deviation, normal distribution and effect of independent variables to dependent variables were investigated. In the comparison of the two-stage groups, t-test analysis and in comparison of the three-stage groups variance analysis (ANOVA) tests were used. Correlation analysis was applied with the aim of determining relations between attitude, knowledge and behavior levels. P values less than 0.05 were considered statistically significant in the study.

Results and Discussion

When the scores of the teachers in the environment awareness scale, the attitudes towards the environment, and the scores of the environmentally friendly behavior tests were examined, it was seen that the attitude level was highest with 83,003, the knowledge level with 77,086 and behavior with the lowest value of 54,523.
Table 2 shows that female participants had a higher level of knowledge and attitude about the environment than men and their behavior levels were quite low for both genders:

Table 2. Knowledge, attitudes towards the environment and the relationship between environment-friendly behaviors and gender

Dimensions	**Gender**	**N**	**Average**	**s.s.**	**t**	**p**
Level of Knowledge	Male	75	75,68	6,28	-2,16	0,03*
	Female	227	77,55	6,56		
Level of Attitude	Male	75	78,71	10,05	-5,57	0,0*
	Female	227	84,42	6,77		
Level of Behavior	Male	75	55,44	7,96	1,19	0,23
	Female	227	54,22	7,57		

*p<0,05

A group of about 10% of the teachers who participated in the study said they were members of environmental organizations. Despite the fact that the member teachers constitute a small group of the sample, the level of knowledge and attitude is higher and meaningful than that of the non-members.

Table 3. Relationship between information about environment, attitudes towards environment and environment-friendly behaviors and membership status

Dimensions	Are you a member of an organization related to the environment?	n	Average	Standard Deviation	t	p
Level of Knowledge	Yes	28	79,93	7,93	2,44	0,02*
	No	274	76,80	6,32		
Level of Attitude	Yes	28	87,04	5,91	2,80	0,01*
	No	274	82,59	8,17		
Level of Behavior	Yes	28	51,14	7,11	-2,47	0,01*
	No	274	54,87	7,65		

*p<0,05

Talking about the environment in their most comfortable home, will be instrumental in raising the awareness of the surrounding community about environment and environmental issues in their everyday lives. As shown in Table 4, it was found that the frequency of speaking about environmental problems at home was influential on the level of knowledge, the level of knowledge and attitude of the participants who did not speak at home about environmental problems was lower than the level of occasional speaking participants. Teachers' levels of the frequency of speaking about environmental problems at home have a reverse effect on their level of behavior, participants who did not speak at home about environmental problems were found to be at a higher level than other participants.

Table 4. Relationship between information about environment, attitudes towards environment and environment-friendly behaviors and the frequency of speaking of environmental problems at home

Dimensions	How Often Do You Talk About Environmental Problems at Home?	N	Average	s.s.	F	p	Difference
Level of Knowledge	Never (1)	21	73,52	5,61	5,56	0,01*	1<2,3
	Rarely (2)	179	76,76	6,33			
	Occasionally (3)	102	78,39	6,76			
Level of Attitude	Never (1)	21	73,19	11,68	25,47	0,01*	1<2,3
	Rarely (2)	179	82,55	6,69			
	Occasionally (3)	102	85,81	7,77			
Level of Behavior	Never (1)	21	58,19	6,74	5,55	0,01*	1>2,3
	Rarely (2)	179	55,07	8,19			
	Occasionally (3)	102	52,81	6,48			

*p<0,05

The influence of frequency of speaking about environmental problems with teachers, who are their colleagues, have on knowledge, attitude and behavior have similar results on the frequency of talking about the environment with their families. A similar situation has been expressed in the work done by Erten et al. (2003) with pre-school teachers and it has been seen that the teachers have spoken about environmental problems with their colleagues but have failed to participate on the works that need implementation for the environment.

The media, an important leg of informal education, is effectively reaching both children and adults; being an informing tool about environmental education issues and environmental problems. Teachers who are asked about their level of follow-up the news about the environment in the newspapers which is a part of written media, a very small part of it stated that they never read, mostly few and occasional answers were given.

Table 5. Relationship between information about the environment, attitudes towards the environment and environment-friendly behaviors and follow-up of environmental problems from written media

Dimensions	**Do you read the news about environment on written media?**	**N**	**Average**	**ss**	**F**	**p**	**Difference**
Level of Knowledge	Never (1)	10	73,30	4,16	6,29	0,01	1<2,3
	Rarely (2)	166	76,23	6,19			
	Occasionally (3)	126	78,51	6,83			
Level of Attitude	Never (1)	10	69,90	11,22	28,24	0,01	1<2,3
	Rarely (2)	166	81,58	6,98			
	Occasionally (3)	126	85,92	7,68			
Level of Behavior	Never (1)	10	58,50	7,68	8,25	0,01	3<1
	Rarely (2)	166	55,80	7,89			
	Occasionally (3)	126	52,53	6,91			

*p<0,05

As seen in Table 20, it was determined that teachers' level of reading the news about the environmental problems was influential on the level of knowledge, the participants who did not read the news had lower levels of knowledge and attitude compared to those who read few and occasionally. It has been found that teachers' reading levels on news about environmental problems have an adverse effect on the behavior levels, and the attitudes of the participants who never read the news were higher than those who read occasionally.

When the relationship between information, attitude and behavior levels were examined, it was found that there was a positive(moderate), medium power and a meaningful relationship between the knowledge levels and attitude levels of the teachers. ($r = 0,436$, $p < 0,01$). This suggests that teachers have developed a positive attitude toward the environment as the level of knowledge about the environment increases. At the same time, as their attitudes increased, they also came to the conclusion that they were willing to learn new information about the neighborhood.

Table 6. Level of Relationship Between Information about the Environment, Attitudes Towards the Environment and Environment-Friendly Behavior

		Level of Knowledge	**Level of Attitude**	**Level of Behavior**
Level of Knowledge	r	1		
	p			
	N	302		
Level of Attitude	r	,436**	1	
	p	0,001		
	N	302	302	
Level of Behavior	r	-,192**	-,218**	1
	p	0,001	0,001	
	N	302	302	302

***Significant relationship at level 0,01*

Conclusion

The results of the independent variables related to environment, attitudes related to environmentally friendly behaviors. The independent variables of the work; gender, membership status in an environmental organization, frequency of taking environmental problems in the family agenda, follow up of the media in the context of environmental problems and making additional activities for the environment with their students have an effect on the level of knowledge and attitudes of teachers. Also, taking care of plants at home has an impact on improving positive attitudes towards the environment.

When analyzing item-based scores and total scores in terms of environment-friendly behaviors, almost every independent variable is also at the lowest level of environment-friendly behavior. Also, contrary to what is expected, the level of behavior of teachers who are members of environmental organizations, family at home and colleagues at school and who are discussing about the environment and who are following the media about the environment and working with the students about the environment are less eco-friendly than other teachers.

It is highly probable that teachers' life habits are more friendly to the environment because of economic concerns, and also it is not a conscious decision. In other words, economic concern leads to environmental awareness, resulting in teachers' behavior serving for environmental awareness become far from eco-friendly behavior and for economic purposes. They may become ecocentric individuals by increasing the level of attitude by prioritizing the environment without making the cost benefit relation a priority (Erten, 2012).

When the regression analysis of teachers' level of knowledge, attitude and behavior revealed their environmental awareness, information about the neighborhood was explained by R2 = .44, R2 = .51 for environmentally friendly and R2 = .13 for environmentally friendly behavior. It is an important finding that the teachers' behavior levels are at a low level both in terms of estimating environmental awareness and total scores. While teachers are inadequate to transform their knowledge of the environment into behavior in their own lives, it should be discussed their role of educating and role modeling, and their impact on making society more environmentally conscious.

Recommendations

Increasing the environmental awareness of teachers is of great importance for the education system. The most critical finding of this study is the low rate of teachers' conversion of information about the environment and the attitude towards the environment into environmentally friendly behavior. The consequences of the ineffectiveness of teachers in transforming knowledge and attitude into behavior are quite striking and demonstrate the need of immediate action for teachers who guide the education system.

Trainings should be arranged so that they can recognize the environment by living, making in nature and away from the classical in-service training concept so that the change of eco-friendly behaviors can be realized. Güler (2010), Öztürk (2013) and Candan & Erten (2015) conducted such practical training with candidate that it left an effective trace on teachers and in-service teachers. A large-scale, full-fledged workshop with teachers should be carried out and a map of the environmental education of our country should be uncovered.

Based on the results of the research, following the media has a significant impact on teachers' environmental awareness. Taking this as a basis, it will have an environmental awareness-enhancing effect on teachers and students if they keep up with environmental news. The preparation of environmental panels on schools will be effective in raising awareness of the sharing of environmental issues related to nearby and remote environments. Another result emerging from the survey is the relationship between membership in environmental organizations and environmental awareness. Increasing voluntary work in environmental organizations will only be possible with the introduction of environmental organizations. By a protocol between The Ministry of National Education and these environmental organizations, these organizations should be promoted to teachers and schools. Through these organizations, students and teachers will be able to access up-to-date news about the environment in the school environment and environmental information of the whole schools will be increased.

The fact that environmental consciousness of teachers who speak environmental problems with families at home and colleagues at school is higher than those who do not speak is an important finding for what should be done in formal education. Teachers should include students' parents and peers in the process in order to increase environmental awareness, and activities aimed at sharing environmental problems at home should be preferred. Analyzes of school consumption should be made in order for schools to effectively implement recycling practices and saving use of resources, and students should be encouraged to do such activities at home, while recycling practices are encouraged at school.

Acknowledgements

This study is derived from the master thesis of Karaismailoğlu (2018) prepared in the supervision of Prof. Dr. Sinan Erten.

References

Bozkurt, . (2011). Fen ve Teknoloj Öğretmen Adaylarının e vre Kavramları le lg l Algılamalarının Değerlend r lmes ve Bu Algılamaların e vreye önel k Tutumları le Tutarlılığının ncelenmesi, *Çukurova Üniversitesi, Sosyal Bilimler Enstitüsü, İlköğretim Anabilim Dalı, Yüksek Lisans Tez*, Adana.

Büyüköztürk, Ş. (2006), *Veri Analizi El Kitabı*, 6. Baskı, Ankara: Pegem A ayıncılık.

Candan, S., & Erten, S. (2015). Pre-Service Teacher Opinions About Eco-Friendly Person Activity Package Developed to Raise Environmental Awareness. *International Electronic Journal of Environmental Education*, *5*(2).

Davis, J. (1998). Young children, environmental education, and the future. *Early Childhood Education Journal*, 26 (2), 117-123.

Derman, . (2013) Farklı Başarı Düzeyler ndek kullarda 9 ve 12. Sınıf Öğrenc ler n n Ekos steme l şk n Öğrenme Düzeyler ve Sürdürüleb l r e vre B l nc le l şk s , *Hacettepe Üniversitesi, Sosyal Bilimler Enstitüsü, Eğitim Bilimleri Anabilim Dalı, Yüksek Lisans Tez,* Ankara.

Erten, S. (2000). *Empirische Untersuchungen zu Bedingungen der Umwelterziehung –ein interkulturellervergleich auf der Grundlage der Theorie des geplanten Verhaltens*. Tectum Verlag. Marburg.

Erten, S., Özdemir, P., & Güler, T. (2003). kul öncesi eğitim kurumlarındaki öğretmenlerin çevre bilinci düzeylerinin ve bu okullardaki çevre eğitiminin durumunun belirlenmesi. *OMEP: 2003*.

Erten, S. (2005). kul öncesi öğretmen adaylarında çevre dostu davranışların araştırılması. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *28*(28).

Erten, S. (2012). Türk ve Azeri ögretmen adaylarinda çevre bilinci. *Egitim ve Bilim*, *37*(166), 88.

Ertürk, S. (1970). n ıl Önces ne Kıyasla Öğretmen Davranışları. *Milli Eğitim Bakanlığı Planlama Araştırma ve Koordinasyon Dairesi*, 83-85.

Ertürk, S. (1988). Türkiye'de eğitim felsefesi sorunu. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *3*(3).

Gigliotti, L. M. (1990). *Environmental Education: What Went Wrong? What Can Be Done?.* The Journal of Enviromental Education, 22 (1), 9-12, Fall.

Gökçe, N., Kaya, E., Aktay, S., Özden, . (2007). lköğretim öğrencilerinin çevreye yönelik tutumları. *İlköğretim Online*. 6(3): 452-468.

Güler, T. (2010). Ekoloji temelli bir çevre eğitiminin öğretmenlerin çevre eğitimine karşı görüşlerine etkileri. *Eğitim ve Bilim*, *34*(151).

Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The journal of environmental education*, *21*(3), 8-21.

'Gorm an & Davis (2012): Ecological footprinting: its potential as a tool for change in preservice teacher education, *Environmental Education Research*, DOI:10.1080/13504622.2012.749979

Öztürk, E. (2013*). Uluslararası bir çevre eğitimi projesinin fen ve teknoloji öğretmen adaylarının çevre bilincine etkisi.* (Doctoral dissertation) *Hacettepe Üniversitesi,* 145s, Ankara.

Schrenk, M. (1994). *Umwelterziehung an der Förderschule*. IPN. Kiel.

Tanrıverdi, B. (2009). Sürdürülebilir çevre eğitimi açısından ilköğretim programlarının değerlendirilmesi. *Eğitim ve Bilim*, *34*(151).

Teksöz, G., Şahin, E., & Ertepınar, H. (2010). e vre okuryazarlığı, öğretmen adayları ve sürdürülebilir bir gelecek. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *39*(39).

Travis, H. J. G. (2007). *The effects of a required ecological course on the environmental attitudes of eighth grade students in a western Pennsylvania school district.* (Doctoral dissertation, Indiana University of Pennsylvania, USA).

Ünal, S., & Dımışkı, E. (1999). UNESC -UNEP himayesinde çevre eğitiminin gelişimi ve Türkiye'de ortaöğretim çevre eğitimi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *17*(17).

Ünal, S., a nçuhan, E., Sayar, A.A. (2001). *Çevre Bilinci, Bilgisi ve Eğitimi*. eni Teknolojiler Araştırma

UNFCC (2005). United Nations Climate Change: Kyoto Protocol UNFCC (2005). United Nations *Climate Change: Kyoto Protocol.* (2018, February 8) Retrieved from http://unfccc.int/kyoto_protocol/items/2830.php

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 104-119

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

How Do Early Childhood Education Pre-service Teachers view Science and Scientists?

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Abstract: The aim of this case study was to collect and to assess students' views about their NOS understandings at the beginning and at the end of their course on teaching science. The study was conducted on 24 students, all females, in their 3rd semester (2nd year), enrolled in their initial teacher education program in early childhood education. Data were collected from 1) Draw-a-scientist-at-task tool, 2) pre- and post-questionnaires about students' views about science and scientists and 3) students' formative and summative assessment scores. To increase the validity of results, a member checking was used. Results showed that prospective teachers' views about NOS improved significantly after attending only one course and the that majority of students agreed on the importance of learning more about science for their professional development.

Keywords: Nature of science, Pre- service teachers, Early childhood, Pedagogical content knowledge, Science literacy

Introduction

Science is often sadly neglected in the early childhood classroom (Johnson, 1999). Perhaps this is because science is "perceived and presented as too formal, too abstract, and too theoretical – in short, too hard for very young children and their teachers" (Johnson, 1999, p. 19).

The Next Generation Science Standards (NGSS) (2013) aims at preparing students for college, careers and citizenship and this by designing classroom experiences that stimulate K-12 students' interests in science. Moreover, both the National Science Education Standards (National Research Council, 1996) and Benchmarks for Science Literacy (American Association for the Advancement of Science, 1993) call for an action-oriented and inquiry-based approach to science with young children.

The need to focus on science in the early childhood classroom is based on a number of factors currently affecting the early childhood community. First and foremost is the growing understanding and recognition of the power of children's early thinking and learning. Research and practice suggest that children have a much greater potential to learn than previously thought, and therefore early childhood settings should provide richer and more challenging environments for learning. In these environments, guided by skillful teachers, children's experiences in the early years can have significant impact on their later learning. In addition, science may be a particularly important domain in early childhood, serving not only to build a basis for future scientific understanding but also to build important skills and attitudes for learning.

Lately, educators recommend doing in-depth research about science in early childhood years, after the big attention to the middle and secondary schooling. Currently many studies focus on the pre-school level because it has an important influence on student choice for future careers in science or engineering than in other grade level. So, the more the teacher creates amazing experiences in science, the more the students want to learn more about science, are motivated and want to explore more! The more teachers will have a greater impact on these students that last throughout their entire school experience.

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

One of the primary goals of the early childhood science curriculum is the development of scientific thinking in young children. Scientific thinking differs from the learning of scientific facts in that scientific thinking involves children in the process of finding out. Instead of learning what other people have discovered, scientific thinking leads children to make their own discoveries. Scientific thinking is manifest as young children ask questions, conduct investigations, collect data, and search for answers.

Science Literacy and Nature of Science

The OECD (2007) PISA study determined scientific literacy in three dimensions: Scientific concepts, scientific processes, and scientific situations. "Scientific situations, selected mainly from people's everyday lives rather than from the practice of science in a school classroom or laboratory, or the work of professional scientists". Holbrook and Rannikmae (1997, p. 15) defined scientific literacy as: "Developing the ability to creatively utilize sound science knowledge in everyday life or in a career, to solve problems, make decisions and hence improve the quality of life".

In Year 2000, during the 2nd International IPN-symposium on Scientific Literacy, held in Kiel, Northern Germany, science educators agreed the lifelong competencies to be gained by students with regard to 3 domains: knowing, doing and assessing. These competencies were grouped under the Graeber model (Figure 1), as stated in Holbrook and Rannikmae (2009, p. 278).

Figure 1. The Graeber Model for Science Literacy (Holbrook & Rannikmae, 2009, p. 278)

Moreover, Chiapetta et al. (1991) identified the four aspects of scientific literacy: 1) the knowledge of science, 2) the investigative nature of science, 3) science as a way of thinking or knowing, and 4) the interaction of science, technology and society (STS). In the third aspect, there is emphasis on the description of how scientists experiments and emphasis on thinking, reasoning, and reflection in the construction of scientific knowledge and the work of scientists.

Understanding of the nature of science, the goals, values and assumptions essential in the development and interpretation of scientific knowledge has been an objective of science instruction since at least the turn of the last century (Lederman, 1992). It is regarded in contemporary documents as a fundamental attribute of science literacy and a defense against unquestioning acceptance of pseudoscience and of reported research. Knowledge of the nature of science can enable individuals to make more informed decisions with respect to scientifically based issues; promote students' in-depth understandings of "traditional" science subject matter; and help them distinguish science from other ways of knowing.

Akerson et al (2011) found that it is clear that students as young as kindergarten are developmentally capable of conceptualizing NOS when it is taught to them. They recommend for teaching NOS to young children, and for future studies that explore learning progressions of NOS aspects as students proceed through school. Research shows also that most children have formed an opinion (positive or negative) about science by the time they reach the age of 7 (Wells, 2015). The teacher's role is critical to children's science learning, and it is a complex one that is informed by her knowledge of children, of teaching and learning, and of pedagogical science knowledge. Finally, though an appropriate understanding of nature of science (NOS) has been recommended for all as a component of scientific literacy (DeBoer, 1991), it is clear from recent studies that students continue to graduate from high school with many misconceptions regarding NOS (Bell et al. 2003).

Lebanese students ending K-12 do not have an adequate view about NOS. BouJaoude (2002) analyzed the new Lebanese Curriculum in Science with regards to the four aspects of science. He found that Lebanese students learnt lots about scientific facts during all the schooling years but the aspect "science as a way of knowing, or science as a way of thinking" So students enrolled at the faculty in their first years, have no idea about science literacy and more specifically about the habits of minds (e.g., creativity, critical thinking and imagination…) For this reason, it is important for early childhood pre-service teachers to be prepared to learn about NOS during their initial teaching at the faculty of education and subsequently to teach to young children NOS.

Importance of the Research

Worldwide, most of educational research in science education focus on in-service /prospective science teachers, but little is done regarding ECE prospective teachers who will teach science in the preschool. In the Arab world, little attention was given to research in science for early childhood and primary classes. In fact, Ayoubi (2017) did an analysis of research in education in the Arab World between 2011 and 2015. Her study showed the scarcity of research done in Science Education: From 6545 publications, only 122 are related to science education and only 2 were addressing science in primary classes or 0.03% of the sample.

In Lebanon, based on my experience as instructor in the last 10 years at the Faculty of Education, little research was done on this group of students and especially the evaluation of the course "Teaching Science for ECE" at the Faculty of Education, Lebanese University.

In addition, I used to start the first session with a diagnostic assessment using the 12 statements on the "Myths of Science" quiz of Chiappetta and Koballa (2004), in order to know more about students' prior knowledge of science. It was striking that each year, most students answered by yes to the statement: Most scientists are men because males are better at scientific thinking.
The present study is a descriptive case study and its research questions are:

1. What are pre-service early childhood education views about NOS?
2. Did pre-service teachers change their views about science and scientists after attending the teaching science course? If yes, in what ways?
3. Did ECE pre-service teachers benefit from the course at initial education program "Teaching Science for Early childhood Education" at the Faculty of Education, Lebanese University? In case yes, in what ways?

Method

The aim of this case study was to collect and to assess students' views about their NOS understandings at the beginning and at the end of their course on teaching science. It was conducted on 24 students, all females, in their 3rd semester (2nd year), enrolled in their initial teacher education program in early childhood education during the academic year 2015-2016.

Procedure

The science teaching course covered 3 major themes: Learning theories and cognitive development theories, teaching strategies for infant and primary classes and Nature of Science and Science Literacy (Figure 2).

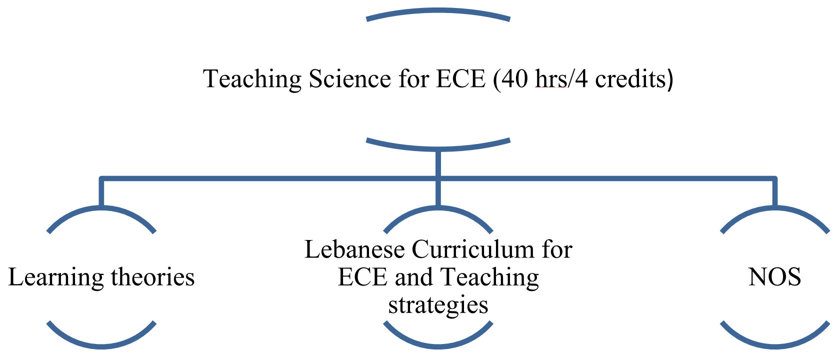


Figure 2. Components of the Science Teaching Methodology course for ECE Education

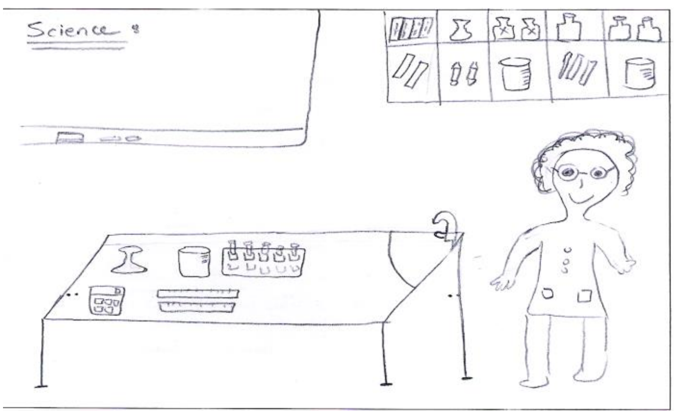
Research data collection tools and sample

The type of this study is a descriptive case study and exploratory of nature (Creswell, 2014). The validity is ensured through heavy description and the use of data multiple sources (Yin, 2014). All 24 students filled in the pre-questionnaire at the beginning of the winter semester, during the first session of the course Teaching Methodology in Science for Early Childhood Education. In the first session, 22 students made the summative exam.

Qualitative and quantitative data were collected from 1) Draw-a-scientist-at-task tool (Figure 3), 2) pre- and post-questionnaires about students' views about science and scientists, 3) students' formative and summative assessment scores and 4) analysis of ECE students' answers related to NOS in the summative test . To increase the validity of results, a member checking was used. The research study duration was 2 semesters.

The pre-questionnaire is formed of 12 open-ended questions, including 7 items related to the DAST-C test and 5 questions related to NOS. The post-questionnaire consisted of 12 items, including 4 items related to students' comments on the Teaching course, 5 items related to NOS and 3 items related to the class debriefing.

During the spring semester, a member checking session was taken place and 17 students filled in the post-questionnaire. A PowerPoint displayed the analysis of students' answers to the pre-questionnaire, in terms of; the course expectations, and Nature of science. Students then have to write their comments after watching the PowerPoint.



1. Scientist working in- or outdoors
2. Relevant captions
3. Symbols of research
4. Symbols of knowledge
5. Technology represented
6. Gender
7. Caucasian only
8. Mythic stereotypes
9. Indications of danger
10. Face expression
11. Clothing

Figure 3. Draw-A-Scientist-Task indicators

Results and Discussion

Data and Results from the pre- and post-questionnaires

Results related to the research question 1: What are pre-service early childhood education views about NOS?
Pre-service teachers' views about scientists from the DAST- drawing

From the pre-questionnaire, 22 drawings were analyzed based on guidelines provided by DAST-C or Draw-A-Scientist-Test Checklist, developed by Finson, Beaver and Cramond (1995). Characteristics of stereotypical images of scientist such as lab coat, eyeglasses, symbols of research, technology, workplace and gender were considered. Teachers' and students' perceptions were analyzed not only through their drawings but also through their responses to the open-ended questions.

The following Tables 1, 2 and 3 highlighted students' answers related to DAST-C.
Overall, the scientist is a white male, working alone and doing experiments especially in chemistry. He is a normal person with no mythic stereotype (such as the crazy scientist or Frankenstein). He has good qualities such as smart, respects others' opinions, tolerant.. Students' favorite scientist are mostly from social and psychology science (Montessori, Piaget..). As for scientists like Newton, Einstein.. because they knew about them in the science textbooks in school time. Only one student mentioned an Arab scientist (Ibn-Alhaytham). The majority of the participating students gave examples of Western scientists only and only very few of them named female scientists.

Table 1. Analysis of students DAST drawings

DAST Indicators	Total	DAST Indicators	Total
1. Workplace	21	2. Relevant captions	5
Scientist working indoors	20	No captions	15
Scientist working alone indoors	19	Thoughts/big questions	2
Scientist working indoors with 2 students	1	Science- word	1
Scientist working outdoors	1	Chemical formulas	1
3. Symbols of research	21	Terms related to separation of salty water	1
lab equipment, e.g., test tube, flask, Erlenmeyer, pipette and Bunsen	18	4. Symbols of knowledge	17
		Board and chalk	2
Instruments for dissection	1	Instruments related to chemistry	12
Instruments for planting	2	Plants	2
5.Technology used	2	Poster	1
Calculator	1	Atomic model	1
Microscope	1	microscope	1
Not present	19	Not present	5
8. Mythic expression	0	6. and 7. Gender /Caucasian only	
Mythic expression	Not present	White male	20
Mother with her daughter	1	White female with a kid	1
10. Facial expression	22	9. Indications of danger	0
Young male smiling	6	Not present	13
Young female smiling	1	No, fire	8
Young male smiling with spiky hair/long hair	5/3		
Smiling young male with beard/mustache/bold	1/4/1		
Unsmiling young male	1		
11. Clothing	18		
wearing lab coat	7		
wearing eye glasses	2		
wearing lab coat and eye glasses	7		
Wearing normal clothes (dress, necktie, jeans..)	1/1		
Not drawing his body	3		

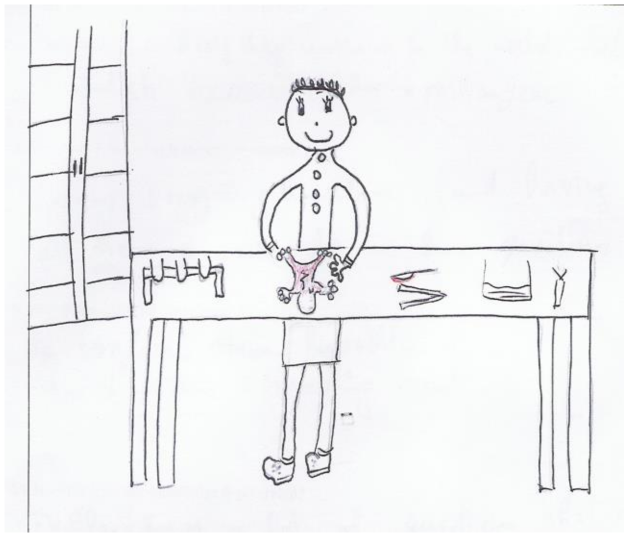
Table 2. Students' answers to DAST open-ended questions

What the scientist is doing	Total	Favorite scientist	Total
Experiment/chemistry experiment	3/10= 13	Newton	3
Dissection of a frog	1	Psychology/social scientists	3
planting	2	Montessori	2
Teaching	1	Skinner	2
Observation	3	Piaget	2
3 tasks	Total	Vygotsky	2
Doing an experiment	16	Ausubel	1
Research	1	Einstein	1
Preparing for the experiment	2	Louis Pasteur	1
Cleaning	2	Galileo	1
Observing/analyzing	10	Ibn-Alhaytham	1
Teaching	2		
Reading books	2		
Walking in nature	1		
Meet with other scientists	1		

Student 24: the scientist works on some experiments that lead him to get answers to his questions

Student 11: the scientist is doing an experiment

Student 8: the scientist is testing the hypotheses



Student 3: the scientist is dissecting a frog

Figure 4. Students' DAST-C drawings

Table 3 resumes attributes to the scientist in students' drawings; all the mentioned qualities were good ones. Students believed that the scientist is a smart person with positive values, such as, tolerance respectful and passionate about his work. In their pre-drawings, students stressed on the scientist intellectual and affective skills. In the post-drawings, the scientist affective skills increased with more emphasis on the attribute: patience.

Table 3. Students' answers about scientist attributes

	Three qualities of a Scientist	Pre-questionnaire Total (N=24)	Post-questionnaire Total (N=17)
Cognitive skills	Smart	9	6
	Intelligent	5	5
	Clever	2	3
	Genius	1	-
	Wide knowledge/Well-educated	2	-
	Has a vision	2	1
	Thinks logically	2	-
	Passionate about his work	1	3
	Objective	1	-
	Total number of answers	**25**	**18**
Psychomotor skills	Hard worker	3	3
	Active	3	-
	Takes risks	1	2
	Sharp observer	3	1
	Good-mannered	1	1
	Communication skills	1	-
	Works with technology	-	1
	Polite	-	1
	Solves problems with wisdom	-	1
	Total numbers of answers	**12**	**10**
Social-affective skills	Patient	2	4
	Does not accept failure	1	-
	Self-examination	1	-
	Helpful	1	2
	Courageous	2	-
	Self-confident	1	2
	Motivated	2	-
	Lovely	1	2
	Explorer	1	1
	Tolerant	1	3
	Respects others' opinions	1	1
	Curious	-	2
	Normal person	-	3
	Creative	-	1
	Has imagination	-	1
	Helpful	-	1
	Cooperates with others	-	1
	Total number of answers	**14**	**24**
	No answer	**4**	**2**

Results related to the research question 2: Did pre-service teachers change their views about science and scientists after attending the teaching science course? If yes, in what ways?

Tables 4 and 5 display excerpts to students' answers open-ended questions in the pre- and post- questionnaires. These questions were: 1.What does the word "science" mean to you? 2. In your opinion, what is the goal of science? 3. Why do scientists do experiments? 4. How the scientific knowledge is generated? 5. Do you think that the scientific method is the only way to do science? Why do you think so? To these questions, students' answers were numerous and diverse. Samples of students' answers to some of these questions are tabulated in Tables 4 and 5.

Table 4. Students' answers about science

Category	ECE students' answers	Pre-Total	Post-Total
Science definition (what's science)	it is biology, physics, chemistry	4	1
	Everything related to life, humans, animals, plants, environment…	10	9
	To do experiment, to observe, to test, having results	7	2
	It is knowledge, information, laws, facts	2	-
	To discover, to explore	3	2
	Searching for answers we ask about things	1	1

When asked how scientific knowledge is generated, students emphasized, in the pre-questionnaire, e.g., on teaching and learning, from scientist to student and to other students, teaches knowledge from one generation to the other, by reading articles, books, internet and by doing experiments. In the post-questionnaire, their answers were, doing more observation and experiments and by reading.

To the question related to the scientific method, students answered by yes. Their answers changed, in the post-questionnaire, this number decreased (Table 5).

Table 5. Students responses about the scientific method as the only way to do science

	Pre-questionnaire (N= 22)	Post-questionnaire (N= 17)
Students' answers	No, you do not have to be a scientist to do science No, sometimes some people are not related to science and they can discover new methods by luck No, the scientific method is not the only way to do science, lots of experiences can be made at home or in TV show and it doesn't need professional things No, because some hypothesis cannot be applied Yes, since it give us a specific answers for our unknown questions Yes, since science gives us answer and information we need	No, you can do science at home with simple materials No, it may be anyone can discover new things and use it No, there are many ways to learn science No, it can be learned from our life also, by trying it No, there are many methods we can do science No, maybe by observation Yes, in order to do science, you need steps to research Yes, because it is hard to learn new methods without a scientific method about it Yes, because this is the only way I know and it is good
Did not fill in the questionnaire	2	3
No	3	3
Yes	7	-
No answer	4	2

Related to the 4 aspects of Science Literacy

Students' answers related to NOS from the pre- and post-questionnaires were coded, analyzed, and categorized according to the four aspects of „Scientific Literacy" presented by Chiappetta and Koballa (2010, p.105): 1. Science as a body of knowledge, 2. Science as a way of investigating, 3. Science as a way of knowing and 4. Interaction of Science with Society and Technology (STS).

Table 6. Percentage of students' answers related to "what's science"

What's science?	Aspect 1 (Science as a body of knowledge)	Aspect 2 (Science as a way of investigating)	Aspect 3 (science as a way of knowing)	Aspect4 (Science, Technology and society)	Aspect 1&2	Aspect 1 & 4
Before Total= 24	4 16.66%	5 20.83%	0 0%	4 16.66%	7 29.16%	0 0%
After Total= 17	6 35.29%	1 5.88%	1 5.88%	1 5.88%	2 11.76%	3 17.64%

Table 7. Percentage of students' answers related to "why do scientists experiments?"

Why do scientists experiments?	Aspect 1 (Science as a body of knowledge)	Aspect 2 (Science as a way of investigating)	Aspect 3 (science as a way of knowing)	Aspect 4 (Science, Technology and society)	Aspect 1&2	Aspect 1 & 4
Before Total= 24	1 4.16%	15 62.5%	1 4.16%	4 16.66%	0 0%	0 0%
After Total= 17	1 5.88%	4 23.52%	0 0%	0 0%	3 17.64%	7 41.17%

Table 8. Percentage of students' answers related to "what's the goal of science?

What's the goal of science?	Aspect 1 (Science as a body of knowledge)	Aspect 2 (Science as a way of investigating)	Aspect 3 (science as a way of knowing)	Aspect4 (Science, Technology and society)	Aspect 1&2	Aspect 1 & 4
Before Total= 24	2 8.33%	3 12.5%	6 25%	8 33.3%	2 8.33%	-
After Total= 17	0	4 23.5%	0	0	1 5.8%	2 11.7%

Table 9. Percentage of students' answers related to "how the scientific knowledge generated?"

How the scientific knowledge generated?	Aspect 1 (Science as a body of knowledge)	Aspect 2 (Science as a way of investigating)	Aspect 3 (science as a way of knowing)	Aspect 4 (Science, Technology and society)	Aspect 1&2	Aspect 1 & 4
Before Total= 24	0	7 29.1%	6 25%	0	0	5 20.8%
After Total= 17	0	5 29.4%	8 47%	3 17.6%	1 5.8%	1 5.8%

In sum, students view about science changed as well as their perception about the scientific method. Their view about Aspect 2 remain unchanged (empirical science), but they link science with socio-scientific issues (to cure disease, to find solutions to our environmental problems..).

Data from the students' formative and summative tests
Pre-service ECE Teachers scores

Many questions of the formative and summative tests were taken from online quizzes and Chiappetta and Koballa (2004, 2010).

Table 10 shows the content of the summative exam and the number of students whose answers were correct to the items related to the test three main parts: Learning theories, Nature of Science and Lesson plan.
For instance, in the summative exam, to the question II.11: Astrology (predicting your future from the arrangement of stars and planets) is a science (True or False), 11 students answered by true.

Question II. 8: Science can be influenced by race, gender, and nationality or religion of the scientist: 14 out of 22 gave wrong answers.
To the question II.12: Science requires a lot of creativity (True/False), only 9 students answered correctly.
To Question II. 14: Science requires a lot of creativity: 10 out 22 gave wrong answers.

Table 10: Students' scores details in the summative exam

(N=22)/ Total score= 50	Range	Frequency
Learning theories (Question no I/14)	[1-6]	5
	[7-11]	17
	[12-14]	0
Nature of Science (Question no II/16)	[1-5]	0
	[6-11]	17
	[12-16]	5
Lesson plan (Question no III/20)	[0-5]	0
	[6-10]	7
	[11-15]	9
	[16-20]	6

Table 11 displays the students' scores and frequency for both formative and summative tests. In their formative assessment, 16 students took a mark ranged between 61 and 70, while 11 students took a mark ranged between 51 and 60.

Table 11. Students' scores

Students tests	Range	Frequency
Formative assessment/100	[30-40]	1
(N=24)	[41-50]	0
	[51-60]	2
	[61-70]	16
	[71-80]	5
Summative exam (1st session)/100	[30-40]	0
(N=22)	[41-50]	3
	[51-60]	9
	[61-70]	7
	[71-80]	3
Total score (Formative +	[30-40]	0
Summative exams)/100	[41-50]	0
(N=22)	[51-60]	11
	[61-70]	7
	[71-80]	4

Figure 5 compares students' scores in formative, summative scores with their final total score for the course Teaching science methodology.

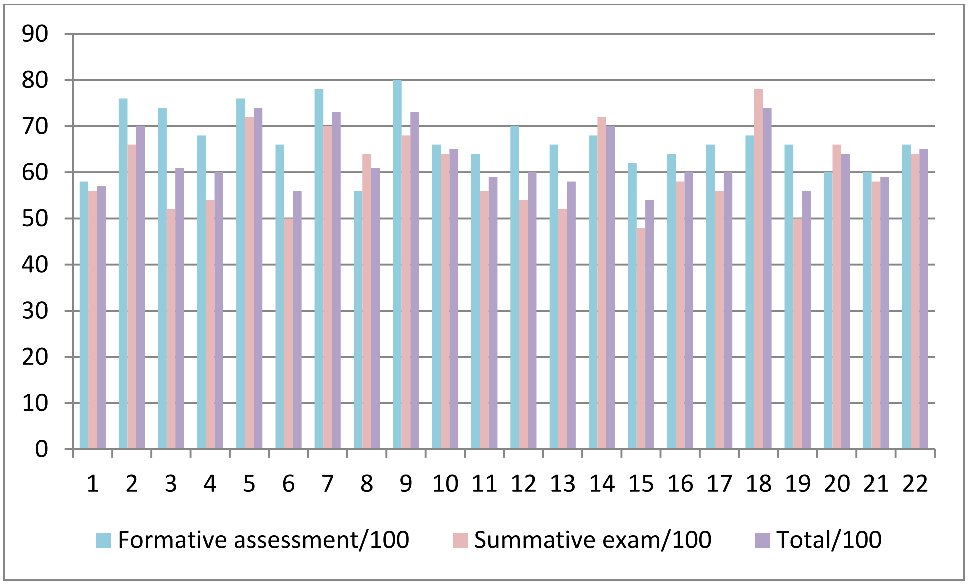


Figure 5. Students' scores from formative and summative tests

Data and Results from the Member Checking Session

Students were asked to fill in a post-questionnaire before the display of the main findings using the PowerPoint (Figures 6, 7 and 8).

About science and the scientist

This is what I concluded about your drawings:

- The scientist you drew is a white male, working alone and doing experiments especially in chemistry. He is a normal person with no mythic stereotype (such as the crazy scientist or Frankenstein). He has good qualities such as smart, respects others' opinions, tolerant.. Your favorite scientist are mostly from social and psychology science (Montessori, Piaget..), because you are now learning about them at the faculty and because you need them in your work as a teacher. As for scientists like Newton, Einstein.. You mentioned them because you knew about them in the science textbooks in school time. Only one student mentioned an Arab scientist (Ibn-Alhaytham) because you do not learn about them in school?
- Tell me, why your scientist is not a female, or of different race?
- Why your scientist did not use any technology in his work?

Figue 6. PowerPoint slide 1 from Member checking session

All students have a known picture about science and it is experiment, plants, animals, humans and this picture we took it from school till now, so we never go to any place to see different picture about science, we see only the picture in chemistry and physics books (Student 19). The scientist is a male and not a female since we always learn the male is scientist at school and the male is stronger than female to work in this field, but it is a wrong idea (Student 20). According to what I learned, all the answers are as a definition and the most answers are that science is everything related to life and to discover, doing experiments and to learn about living and non-living things. I thought imagination is related to literature (Student 12). What you said in the PowerPoint is true, because we learned about some scientists (Newton, Einstein..) from our school. But there are others we are learning about now at the faculty such as Montessori… for Arab scientists, we do not have a lot of information about them. Also all what we learned that they are males, since females should stay at home and work in it. And not all scientists had technology (Student 22). Another student wrote, I believe most scientists are not Arabs because the fact they are related to what we are learning at the present time. A scientist is mainly a male it is because that's what we hear, this is what they told us. Technology is not mentioned because we are not seeing it daily, in our everyday life and I'm not having a relative who is a scientist to observe (Student 3). The scientist is a normal person, who takes correct and incorrect choices (Student 15). The scientist is a normal person, he could

be male or female (Student 14). The scientist did not use technology since we have a background about scientists using old materials (Student 8). It seems we should learn more about science (Student 10).
Only one student' view about scientists persists; the scientist which I drew is not a female because the male is more intelligent than the female and he has a scientific thinking (Student 1).

About the sources of the scientist stereotypical image

To the question, where did you have your image about a scientist?
Most students agreed that the scientist in their pre-drawings were from books and magazines, TV, we are used to have a male scientist, as a student commented. Student 11 wrote: from school and school books. My scientist is not a female or from a different race, not because I am against that but it happened to be a man, because I drew him using a telescope. Student 13 commented that from school, science courses from grade 1 till grade 12, from TV programs such as National Geographic and movies about science. The scientist that we talked about is that we know only from school, whose theories we use in our daily life. Another student responded that from books and from reading and from my science teacher at school. My drawing was male because we did not take scientist female so much. Scientists in the drawings did not use any technology in his work, but they use the microscope sometimes (Student 22).
Finally, a student summarized the position of her peers: Each one of us has a totally different point of view. But we all agree on the same idea that a scientist is a good person (Student 11).
About NOS aspects

This is what I concluded from your answers related to NOS aspects:

- Science is about chemistry, physics and biology, and we need it to understand and to learn about the environment, animals and plants. Science is produced through experiments and scientists do experiments to prove their theories. Science is important to us because it helps us to live better and to discover things that help us. Some of you do not like science because they are afraid of being hurt and because doing science is dangerous.
- But, why no one mentioned about science and innovation, creativity and imagination?

Figure 7. PowerPoint slide 2 from Member checking session

Students' responses about interpretations and question in Figure 7 varied. A student wrote: students have a known picture about science and its experiments, plants, animals, humans and this picture we took it from school till now, so we never go to any place to see different picture about science, we see only the picture in chemistry and physics books. Another comment was: science is a study related to chemistry, physics and biology. It can be produced by experiment to prove theories. I did not mention the relationship between science and imagination, because I did not know this before. In addition, a student believed that all Lebanese students learn in the same way and have the same idea about science. Also all schools focus on science content and ignore materials that include creativity and imagination. Furthermore, a student mentioned that, according to what I learned, all the answers are as a definition and the most answers are that science is everything related to life and to discovery, doing experiments and to learn about living and non-living things. I thought imagination is related to literature. Finally 2 students defined science as everything which has a relation with humans, plants, animals.. To discover, or to explore. The goal of science is to discover and explore more about everything.

- My last questions: would you marry a scientist? (please raise your hands)
- Do you feel that you need to learn more about science? (please raise your hands)
- Do you like to learn about science next year? (please raise your hands)
- Have you changed after this course your image about the scientists? Or it is still the same (as your drawing?)

Figure 8. PowerPoint slide 3 from Member checking session

To questions in Figure 8, only 2 students said that they would marry a scientist; many disagree because they thought that a scientist has no social life. Out of the 17 students, 13 students agree that they need to learn more about science. Finally, all students said yes, that they changed their image about scientists; unlike their pre-drawings, they would draw a scientist at work differently.

Results related to Research Question 3: Did ECE pre-service teachers benefit from the course at initial education program "Teaching Science for Early childhood Education" at the Faculty of Education, Lebanese University? in case yes, in what ways?

Data from the post-questionnaire showed that the 17 students, who were present during the debriefing session, agreed that their expectations about the course *Teaching science Methodology* was largely fulfilled. In particular, epistemology and teaching strategies for KGs. Furthermore, all students want to learn more science courses. e.g., I would know more about science because I do not have enough knowledge (Female 13).

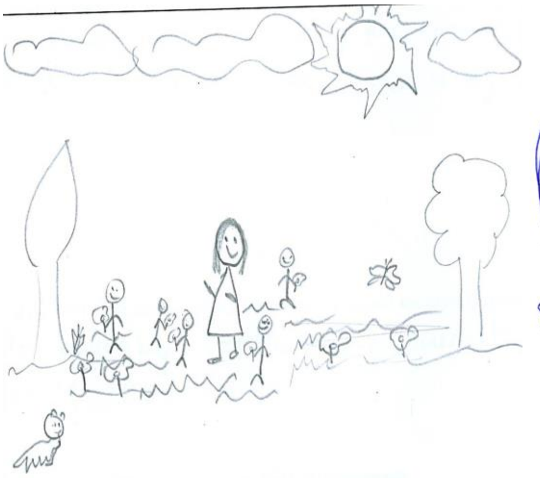
From the post-questionnaire, in Table 12, 16 drawings were analyzed according to DASTL or Draw-About-Science-and-Teaching-Learning (El Takach et al, 2018).

Table 12. Students' drawings according to the 15-DASTL indicators

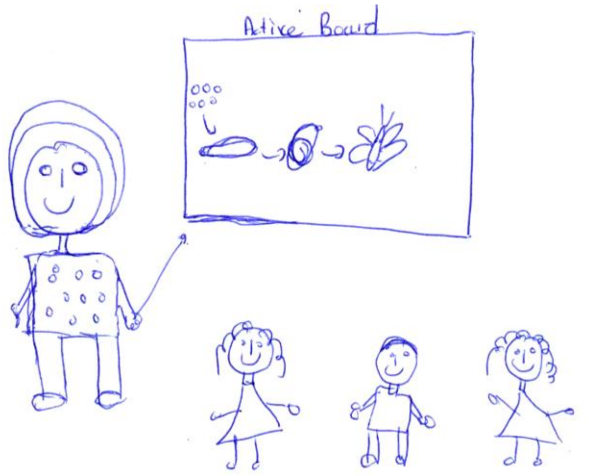
Drawing analysis indicators	**Number of indicators**
a. Teacher's indicators	**35**
1. Teaching practices (e.g. frontal teaching, lab work, group work…)	16
Fieldtrip	8
Demonstration	4
Frontal teaching	2
Game with cards	2
2. Use of technology in instruction (e.g., LCD projector, active board…)	3
3. Teacher' facial expression (e.g. no expression, happy face, smiling…)	
Smiling	15
4. Teacher' gender	16
Female	
b. Student's indicators	**15**
1. Student presence	15
2. Student on task	15
Planting	13
Watching a science activity	2
c. Learning environment indicators	**16**
1. Indoor/outdoor instruction (e.g. classroom, laboratory, outdoor activity…)	16
Classroom	8
Outdoor	8
2. Class management (e.g. how students are seated)	4
In rows	3
On the carpet	1
3. Captions (e.g. teacher's talk, students' talk)	
Science and I love science	2
4. Class interaction (teacher/ student, student/student)	22
Teacher/student	13
Student/student	9
5. Symbol of research (lab equipment,..)	3
6. Symbol of knowledge (book, chalk and board..)	4
7. Technology represented (computer/laptop, calculator..)	3
d. Others	**-**
1. Use of a mind/ concept map	-
2. Use of philosophical metaphor	-
No drawings	**1**

Overall, 8 students draw themselves with their students outdoor, doing real science (planting and observing living species), while 8 drew themselves in class planting with their students or teaching about transportation. Only 3 students drew themselves using ICT in teaching. Finally, 15 teachers stressed on creating an engaging atmosphere by drawing themselves and their students with smiley faces.

Figure 9 shows some students' drawings to the question: Draw a picture of yourself doing science in KGs for your students.



Teacher and students are planting flowers in the school garden and watching the sun and the trees (Student 4)



I am the teacher and teaching the kids about life cycle by using technology (Student 12)

I take my students to the garden to plant (Student 24)

Teacher uses game while teaching. Students become inquirers and learns science with fun

Figure 9. Students' post-drawings about teaching and learning science

Conclusion

Results showed that prospective teachers' views about NOS improved significantly after attending only one course and the that majority of students agreed on the importance of learning more about science for their professional development.

Prospective early childhood teachers' views about science at the end of the course were: all students of the sample agreed that they did not learn before about science literacy and NOS during their school years. There was more emphasis on using terms such as, discovering, sharing ideas, creative work, science is linked to real life. Terms such as, I like science, were more frequent.

Overall, from the pre-questionnaire, Science is about chemistry, physics and biology, and we need it to understand and to learn about the environment, animals and plants. Science is produced through experiments and scientists do experiments to prove their theories. Science is important to us because it helps us to live better and to discover things that help us. Some of students did not like science because they are afraid of being hurt and because doing science is dangerous.

Also, the scientist is a white male, working alone and doing experiments especially in chemistry. He is a normal person with no mythic stereotype (such as the crazy scientist or Frankenstein). He has good qualities such as smart, respects others' opinions, tolerant.. Students' favorite scientist are mostly from social and psychology science (Montessori, Piaget..). As for scientists like Newton, Einstein.. They knew about them in the science textbooks in school time. Only one student mentioned an Arab scientist (Ibn-Alhaytham) because you do not learn about them in school. The majority of the participating students gave examples of Western scientists only and only very few of them named female scientists. One explanation for this could be that the national science textbooks mostly illustrate Western male scientists (Yacoubian et al. 2017).
From the post-questionnaire and the debriefing session, all agreed that a scientist is a good person, but he has no social life. Moreover, they believed that they had the stereotypical image of science and scientists from the science textbooks. They realized that science is related to our daily life and it is linked to socio-economic issues. Finally, the science teacher is doing activities with her student outdoors (fieldtrip), or a teacher using ICT in her teaching.

Recommendations

Future studies on large the samples are encouraged in the future, especially those KGs and primary pre-service science teachers' studies in Lebanon are scarce.

Finally, the initial program LMD (Licence-Master-Doctorat) for Early Childhood Education extends over 3 years or 6 semesters. The total credits are 180. Undergraduate courses credits in pure science are only 4 credits (Science activities for ECE course). This study shed the light on the importance of science and NOS for their future career. This study would be a valuable proposition to include the course History and Nature of Science (HNOS) for ECE students and one elective course about science, for the LMD reform committee at the Faculty of Education, Lebanese University.

Acknowledgements

My deep thanks go to the 2nd semester ECE of the academic year 2015-2016, who participated with joy to this study.

References

American Association for the Advancement of Science (1993). *Benchmarks for science literacy*. New York: Oxford University Press.

Akerson, V. et al (2011). The importance of teaching and learning nature of science in the early childhood years. *Journal of Science Education and Technology*, Volume 20, Issue 5, pp 537-549.

Ayoubi, Z. (2017). Research in science education in Lebanon:. Paper presented at the conference organized by entitled "ملتقى النشر في الدوريات التربوية العربية في العلوم: مراجعة نقدية على ضوء الاتجاهات العالمية". Amman, Jordan, July 6, 2017. www.shamaa.org.

Bell, R. Blair L., Crawford, B., & Lederman N. (2003) Just do it? Impact of a science apprenticeship
program on high school students' understandings of the nature of science and scientific inquiry. J Res Sci Teach 40:487–509.

BouJaoude, S. (2002). Balance of scientific literacy themes in science curricula: the case of Lebanon,
International Journal of Science Education. Volume 24, Issue 2, 139-155.

Chiapetta, E., Fillman, D. & Sethna, G. (1991). *Procedures for conducting content analysis of science textbooks*. University of Houston, Department of Curriculum and Instruction, Houston.

Chiappetta, E., & Koballa, T. R. Jr. (2004). Quizzing Students on the Myths of Science. The Science Teacher, p. 58-61.

Chiapetta, E. L., & Koballa, T.R. Jr. (2010). *Science instruction in the middle and secondary schools. Developing fundamental knowledge and skills for teaching*. Upper Saddle River: Prentice Hall.

Creswell, J.W. (2014). *Research design: Qualitative, quantitative and mixed methods approaches* (4th ed). Thousands Oaks, CA: Sage.

DeBoer G.E. (1991) A history of ideas in science education: implications for practice. Teachers College Press, New York.

El Takach, S., Ayoubi, Z., & Rawas, M. (2018, March 2-3*) Using drawings to investigate Lebanese in-service science teachers' views about teaching and learning process: Proceedings of the 12th*

Multidisciplinary Academic Conference on Education (12th MAC 2018), Czech Technical University in Prague, pp. 96-111, https://www.academic-conferences.eu/ ISBN 978-80-88085-18-8.
Finson, K. D, Beaver, J.B, & Cramond , B.L. (1995). Development and Field Test of a Checklist for the Draw-A-Scientist Test. *School Science and Mathematics,* v.95 (4), pp. 195-205.
Johnson, J.R. (1999). The forum on early childhood science, mathematics, and technology education. In American Association for the Advancement of Science (AAAS).*Dialogue on Early Childhood Science, Mathematics, and Technology Education*. Washington, DC: AAAS, pp. 14-25.
Lederman, N.G. (1992). Students' and teachers' conceptions of the nature of science: A review of the research. *Journal of Research in Science Teaching*, 26(9), 771-783.
National Research Council (1996).*National science education standards*. Washington, DC: National Academy Press.
Next Generation Science Standards (2013). *Appendix H: Understanding the Scientific Enterprise: The Nature of Science in the Next Generation Science Standards,* NGSS Release, from https://nextgenscience.org.org.
Organisation for Economic Cooperation and Development (2007). *Assessing scientific, reading and mathematical literacy: A framework for PISA 2006*. Retrieved on 15 December 2015.
Holbrook, J & Rannikmae, M. (2009). The Meaning of Scientific Literacy. *International Journal of Environmental & Science Education,* Vol. 4, No. 3, 275-288.
Wells, S. (2015). Why Early Childhood Education is so Important. The Steven Spangler Science Website. Making Science Fun! Retrieved: 8.10.2015.
Wilson, R (2008). Promoting the Development of Scientific Thinking. Early Childhood News. The Professional Resource for Teachers and for Parents. www. *earlychildhoodnews.com* . Retrieved: 8.10.2015.
Yacoubian, H., Al-Khatib, L & Mardirossian, T. (2017). Analysis of the Image of Scientists Portrayed
in the Lebanese National Science Textbooks. Sci & Educ (2017) 26:513–528, DOI 10.1007/s11191-017-9908-0
Yin, R. K. (2014). *Case study research: Design and methods*. Los Angeles, CA:Sage.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9 Pages 120-126

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Interrelationship between Keeping School Experience Diaries and Student Teachers Empathic Tendencies

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Abstract: The study aimed to examine to what extend preservice chemistry teachers in ool xp n n n p would benefit from empathic tendencies through diary keeping. The sampling of the study consisted of 12 student teachers studying at Hacettepe University Faculty of Education. In the research, Empathic Tendency Scale (Kocak & Onen, 2013) was used with the aim of collecting data. Within the framework of the research, preservice chemistry teachers were asked to keep school experience diaries in order to identify the interrelationship between preservice chemistry teachers' mp i n n i n xp ion in the experience diaries. In addition, elements related to the empathic tendencies of preservice chemistry teachers were eliminated from the student diaries produced in a systematic way to determine empathic tendencies. In this study it is tried to demonstrate how it could be more effective the courses which will be applied in the years ahead.

Keywords: ool xp n , n p , Empathic tendencies, Preservice chemistry teachers

Introduction

Empathy is the process where individuals understand the thoughts and feelings of another while feeling the same way and communicating this to the other under a certain circumstance. Empathy, in educational settings, is a tool in establishing an effective communication between educators and students and in the implementation of training programs; and as well it is a feature, which should be attained by the future planners of the education o (Fo , 1979 i in Uğu , 2007; Kök l & Koç , 2005; Ro , 1983). W il mp y w n n inn bili y, o y' u o n u o mp i om muni ion kill n b l n n taught (Plomin, 1990). Delisio (2006) stated that although most people see empathy as a characteristic trait, in reality, empathy is a social skill, which can and ought to be taught in schools. In addition, given the need for mutual understanding and love between teachers and students, empathy could be clearly seen as a necessity. In this respect, teachers have to use and make beneficial use of empathy in their communications regarding both l n in n in im n i on (Koç k & Onen, 2013).

Individuals with high empathic tendency levels act constructively within their attempts to understand others and on i o p i u i n onfli in i u ion (R b & A , 2009), mp i n n i n kill of student teachers should be sufficient. According to Perry (1968), mental and moral development in the first y of univ i y p n on i n x n l u o i i ; w ll, mo i n in ivi u l' m n l n moral development is, the more the individual tends to act strictly in empathizing (Davis, 1982). Therefore, before starting their teaching profession, student teachers should experience required educational activities to attain empathic skills and to determine their empathic tendencies. Although empathic behaviors could not be taught directly to individuals, some activities could be taught to enable them to uncover their weaknesses and strengths, reveal their existing empathic values and increase their self-awareness. In other words, it is not easy to teach empathy (Okvuran, 1993); however, assistance could be provided for the formation of empathy (Davis, 1968; 1982; Fo , 1979 i in Uğu , 2007; Ko lb , 1969 i in Okvu n, 1993; Ro , 1975 i in Y l m , 1992). In f , li u on in u i uppo iv of f mp y l v l of u n oul b imp ov u l ly in im (E ül, 1995; M & G ç k , 2005; Koç k & On n, 2013). School Experience courses are functional and they are beneficial to familiarize the pre-service teachers with the

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

in p of ion (Y p & Y p , 2004). School Experience Course creates opportunities for preservice chemistry teachers to assimilate their experiences, relate them to the work being done at the university, and to discuss them with the instructor and other students taking the same course. In n p preservice chemistry teachers are expected to acquire teaching competence and develop their teaching skills. Teacher diaries are recognized as useful introspective methods that assist in the professional development of teachers (Maneekhao & Watson Todd 2001; McDonough 1994; Thornbury 1991; Lowe 1984). Diaries are personal accounts of classroom experiences with the aim of finding new insights. They involve an inwardly reflective procedure by thinking back carefully over the lessons, puttin on ' ou in o w i in n n n ly zin these for deeper insights. The self-awareness generated by this contemplative procedure can be beneficial for the personal-professional development of teachers. As such, diaries form a foundation upon which to build l f w n , po n ibili y n onfi n in on ' own in bili y, l l of w i n n u i m for change (Kirazlar, 2007). The study aimed to examine to what extend preservice chemistry teachers in ool xp n n n p would benefit from empathic tendencies through diary keeping.

Method

The aim of the study is to examine the empathic tendencies of the preservice chemistry teachers through the diaries of the contributions of the ool xp n n n p . The sampling of the study consisted of 12 student teachers taking ool xp n n n p at the Faculty of Education in the Department of Chemistry Education at Hacettepe University. The study conducted through hybrid design that combines both quantitative and qualitative patterns. C onb Alp (α) li bili y o ffi i n of Emp i Tendency Scale was calculated to be .94; where Empathic Skill subdimension was .91; Empathic Environment subdimension was .88, and Anti-empathic Attitude subdimension was .82. In the research, Empathic Tendency Scale (Kocak & Onen, 2013) was used with the aim of collecting data. Empathic Tendency Scale is acceptably reliable for the research in social sciences (Kocak & Onen, 2013). The data obtained from the scale were analyzed and interpreted with the help of SPSS 20 (Statistical Package for the Social Sciences) computer program. Within the framework of the research, preservice chemistry teachers were asked to keep school experience diaries in order to identify the interrelationship between preservice chemistry teachers' mp i tendencies and expression in the experience diaries. Before writing up reflective diaries, they were provided ways of how to write up their diaries, stressing p i ul l y n o on n on " i i l v n " taken place in the classroom, and on what they felt about them. The elements related to the empathic tendencies of preservice chemistry teachers were eliminated from the student diaries produced in a systematic way to determine empathic tendencies.

Findings

Within the qualitative research dimension of the study, data collected from preservice chemistry teachers were evaluated through content analysis, while the quantitative dimension of the study was evaluated using tables displaying the statistical analysis results.

Quantitative Findings

In the research, Empathic Tendency Scale (Kocak & Onen, 2013) was used. SPSS 20 computer program was used to analyze the data obtained from preservice chemistry ' p -and post-test empathic tendencies in this first phase of the study. Descriptive statistics of the empathic tendencies, empathic skill, anti-empathic attitude and empathic environment of preservice chemistry teachers are summarized. The first results are seen in Table 1.

Table 1. The descriptive statistical results of preservice chemistry teachers towards the empathic tendencies

Subdimensions	Tests	Mean	Sd
Empathic Tendencies	Pre-test	4.53	.298
	Post-test	4.64	.361

According to the finds (Table 1) that have been acquired at the end of the research, after ool xp n n n p , empathic tendencies of preservice chemistry teachers have increased. The post-test results (X =4.64) are higher than the pre-test results (X=4.53). As it seen in the table above, there has been a positive increase in emphatic tendencies of preservice chemistry teachers.

Table 2. The descriptive statistical results of preservice chemistry teachers towards the empathic skill

Subdimensions	Tests	Mean	Sd
Empathic Skill	Pre-test	4.59	.344
	Post-test	4.69	.338

The results of the empathic skill of the preservice chemistry teachers are shown in Table 2. The post-test results (X =4.69) are higher than the pre-test results (X =4.59). According to the finds that have been acquired at the end of the research, emphathic skills of preservice chemistry teachers have increased.

Table 3. The descriptive statistical results of preservice chemistry teachers towards the anti-empathic attitude

Subdimensions	Tests	Mean	Sd
Anti-empathic Attitude	Pre-test	4.56	.373
	Post-test	4.38	.401

The anti-empathic attitudes of the preservice chemistry teachers were examined and indicated in Table 3. A The pre-test results (X =4.56) are higher than the post-test results (X =4.38). As the table shows, after ool xp n n n p , it has emerged that participation levels of preservice chemistry teachers in anti-empathic attitude choices have decreased.

Table 4. The descriptive statistical results of preservice chemistry teachers towards the empathic environment

Subdimensions	Tests	Mean	Sd
Empathic Environment	Pre-test	4.45	.412
	Post-test	4.66	.495

According to the Table 4 that have been some changes in preservice chemistry teachers points of view about empathic environment. The post-test results (X=4.66) are higher than the pre-test results (X=4.45). In other words, the results indicate that the preservice chemistry teachers showed change in their empathic environment views.

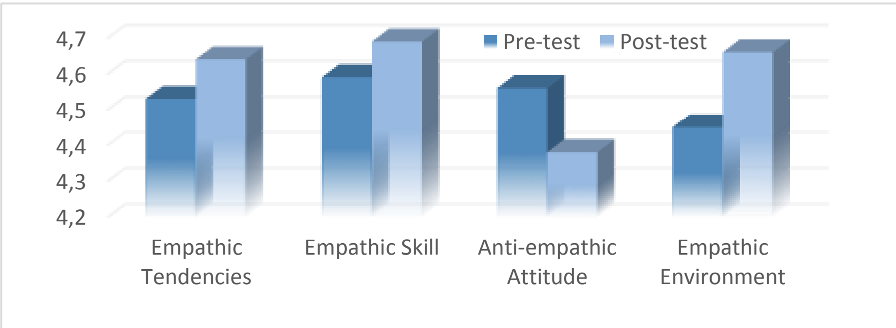

Figure 1. Empathic tendencies of preservice chemistry teachers

When the means of pre and post Empathic Tendency Scale results were taken into account, the post-test results were considerably higher than the pre-test results which might suggest that the diary study might have been effective in this change.

Qualitative Findings

The data were collected from 12 preservice chemistry teachers' i i w i w om pl u in 14 teaching-practice weeks in high schools. D om in f om u n ' fl iv i i w n ly z d by means of qualitative data analysis techniques. The elements related to the empathic tendencies of preservice chemistry teachers were eliminated from the student diaries produced in a systematic way to determine empathic tendencies. It should be noted that not all of the preservice chemistry teachers' diary entries are presented here, rather the most illustrative ones are included. This study tries to find answers to the following research question:

Is there a change between preservice chemistry *teachers' empathic tendencies before the diary study and their empathic tendencies after the completion of the diary study?*

Here are some of the statements produced by the participants:

ST11 observed the effects of strategies on teaching situation. Again in diary excerpt in the 8th week she explicitly stated how participating in this study helped her:

"Empathy and emotions are very important in communication to students. I am very happy to experience it today."

As can be seen from diary entries, ST8 showed signs of a anti-empathic attitude

"I am very sorry for the teachers who do not have empathy skills today. Let's see what we can do…"

As can be seen from diary entries, ST3 showed signs of a negative empathy skills.

"It's not like that. Where is empathy?"

ST7 pointed out how diary study became an alternative way for her.

"When I come to school I try to make a little empathy and always think the student has a different world, a different pain and a different love ... I try to understand all of them."

ST10 pointed out how empathical thinking became an alternative way for her.

"Am I not a student? 18 years of professional student life provides empathical thinking."

Results and Discussion

Empathy is a process, which is more complex than feeling and thinking of an individual in place of another (Stein, 1970) has been subject to various studies on developing data collection tools to assess empathic n n i on i n ifi b i (Dökm n, 1988; Özb y & Ş in, 2000). popul ion of u i b ou empathy was fo m n lly o l n (Ali in noğlu & Kök l , 2000; H m i , 2007; Y lm z, 2009), u n (B y zi & Küçükk ö z, 1996; m u k, 2011; U l, 2010; Uy oğlu, 2011), n preservice teachers (Akbulut, 2010; Dev, 2010; Ekinci, 2009; Ekinci & Aybek, 2010; Kocak & Onen, 2013). Before starting their teaching profession, student teachers should experience required educational activities to attain empathic skills and to determine their empathic tendencies. Although empathic behaviors could not be taught directly to individuals, some activities could be taught to enable them to uncover their weaknesses and strengths, reveal their existing empathic values and increase their self-awareness (Kocak & Onen, 2013). By writing up diaries, student teachers have opportunities to reflect on the basis of their own personalised experiences that have very much meaning for them (Ekiz, 2003).

The aim of the study is to examine the empathic tendencies of the student teachers through the diaries of the contributions of the ool xp n n n p . The study was participated by 14 preservice chemistry teachers studying at Hacettepe University, Faculty of Education. This is a two-dimensional research study where qualitative and quantitative research methods are used together. Data for this study came from: (a) Empathic Tendency Scale and (b) diary entries. The scores obtained by participating groups from The Empathic Tendency Scale (Kocak & Onen, 2013). As for the first phase of the study, primarily, the empathic tendencies of 12 preservice chemistry teachers participated in the diary study were determined with the Empathic Tendency Scale (Kocak & Onen, 2013) given at the end of the study again. As a result, it was found that there was change in their empathic tendencies, empathic skill, anti-empathetic attitude and empathic environment. However, when the means of pre and post Empathic Tendency Scale results were taken into account, the post-test results were considerably higher than the pre-test results which might suggest that the diary study might have been effective in this change.

D oll ion on i of o of p i ip n ' i y n i ou ou u y. R u in p n in preservice chemistry teachers' i y n i w u m ure of their empathic tendencies. The diary entries were compared to check evidence of change in the level of the preservice chemistry teachers' empathic tendencies. The qualitative data was collected by means of reflective diaries written by preservice chemistry teachers. The researcher compared the entries of each student teacher's diary to find out evidence for development of empathic tendencies. The findings obtained from the qualitative data indicate that participating in a diary study helped them consider different means for professional development. This study showed that through diary keeping make preservice teachers gain positive empathic tendencies in general. School Experience I course is beneficial to recognize the teaching profession. In fact, these experiences can be increased by means of the increase in the communication of schools and faculties. Negative empathic tendencies related with schools and students that are encountered during School Experience course was enabled them to understand the seriousness of the teaching profession. The aim of the school experience course is to provide preservice teachers to make observations at schools, to benefit from experienced teachers and to participate in real school environment before occupation. The s ool xp n n n p mpo n b u professional development has a tremendous impact on teachers, therefore, on their students. Calderhead and Shorrock (1997) staten ' p xp i n influ n w y y ink about their work. The aim of the study, through a diary study in ool xp n n n p to determine whether preservice chemistry teachers' m p i n n i woul n o no . Besides, the data collected from the diary were studied to determine whether there was a change in preservice chemistry ' empathic tendencies. In conclusion, this study sheds light on the importance of school experience diaries in teaching profession. In the light of findings, It should be concluded that the diary study is helpful in that it allows for not only a form of reflection but it also emphasizes a step-by-step look at what teachers are doing.

More specifically, no studies have investigated in ool xp n n n p would benefit from preservice chemistry ' empathic tendencies through diary keeping. Hence, it is believed that this study contributes to the literature in this context. In addition, the findings of this study are expected to give feedback about what preservice chemistry teachers learnt from school experience and n p courses to teacher educators. Moreover, preservice chemistry teachers encounter the teaching profession for the first time by means of school experience course. This study showed that school experience n n p courses gained some experiences in their field. The limited number of participating pre-service teachers did not allow the researcher to generalize the findings to a larger group of pre-service teachers. The other limitation is whether pre-service chemistry teachers wrote the real data that they observed or not during their enrollment in School Experience courses. They might not have written what they really wanted to write. Thus, this is another limitation of the present study. According to the results, this study may help teacher educators organize their pre-service education programs.

References

Akbulut, E. (2010). *Sınıf öğretmenlerinin empatik eğilim düzeyleri*. Y y ml nm m ş yük k li n zi, k y Üniv i i , o y l Biliml En i ü ü, k y .

Ali i n no ğlu, F. v Kök l, A . (2000). G nçl in b n u uml v mp ik b il inin in l nm i . *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 18, 11-16.

B y zi , G. v Küçükk öz, H. (1996, Eylül). *Psikodrama eğitimi grubundaki öğrencilerin engellenmeye dayanma düzeyleri ve empatik eğilim düzeylerinin süreç üzerine yansımaları*. II. Ulu l Eği im m pozyumu'n unul n bil i i, M m Ü niv i i , İ nbul.

Calderhead, J. & Shorrock, S. B. (1997). *Understanding Teacher education Case studies in the Professional development of beginning teachers*. Printed in Great Britain: The Falmer Press

Davis, C. M. (1968). *Patient/practitioner interaction: An experiential manual for developing the art of health care*. Thorofare, NJ: Slack Inc.

Davis, C. M. A. (1982). *Phenomenological description of empathy as it occurs within physical therapists for their patients.* Unpublished doctoral dissertation, Boston University, Boston.

Delisio, E.R (2006). Ways to teach empathy skills. Retrieved November 2, 2010 from www.educationworld.com/a_issues/chat/chat166.shtml.

Dev, N. (2010). *İlköğretim okullarında görevli yönetici ve öğretmenlerin empatik beceriler açısından karşılaştırılması (Kartal örneği).* Y y m l n m m ş yük k li n zi, Y i p Üniv i i, o y l Biliml En i ü ü, Eği im Yön imi v D n imi An bilim D l , İ nbul.

Dökm n, Ü. (1988). Emp inin y ni bi mo l y n l k ölçülm i v p iko m il liş i ilm i . *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi*, 11 (1-2), 155-190.

Ekin i , Ö. (2009). Öğ m n yl n n mp ik v l ş i l üşünm ğilim l inin in l nm i . Y y m l nm m ş yük k li n zi , Çuku ov Üniv i i o y l Biliml En i ü ü, A n .

Ekin i , Ö. v Ayb k, B. (2010). Öğ m n yl n n mp ik v l ş i l ü şünm ğilim l i nin incelenmesi. İlköğ im Onlin , 9 (2), 816-827.

Ekiz, D. (2003). n f öğ m ni yl n n öğ m n ği i min ki mo l l kk n üşün l i. *Milli Eğitim Dergisi*, (158), B D ön m i.

E ül, H. (1995). *Sağlık meslek lisesi öğrencilerinin benlik algı düzeyleri ile empatik eğilim ve empatik beceri düzeyleri arasındaki ilişki*. Y y m l nm m ş yük k li n zi, Çuku ov Üniv i i o y l Biliml En i ü ü, A n .

Hasdemir, A. D. (2007). *Ergenlerin ve anne babalarının empatik becerileri ile aile yapılarını değerlendirmeleri üzerine bir araştırma*. Y y ml nm m ş o k o zi, G zi Üniv i i, Eği im Biliml i En i ü ü, Ankara.

Ki zl , Ç. (2007). An inv i ion in o p of ion l v l opm n of p im y ool n li l n u teachers: The effects of keeping diaries on teacher reflection and attitudes towards teaching. MA Thesis, Ç n kk l On kiz M Univ i y In i u of o i l i n En li L n u in D p m n , Ç n kk l .

Koç k, C. & Ön n, A., . (2013). Öğ m n yl için m p ik yön lim ölç ği: G ç li k v ü v ni lik ç l şm . *Kuram ve Uygulamada Eğitim Bilimleri Dergisi*, 13 (2), 947-964.

Kök l A. A. & Koç , Ç. H. (2005). Okul ön i öğ m n yl n n m p ik b i ü z y l inin belirlenmesi. *Eğitim Araştırmaları Dergisi*, 21, 13-23.

Lowe, T. (1984). An experiment in role reversal. *English Language Teaching Journal*. 41 (2), 89-96.

Mete, S. & G ç k , E. (2005). PDÖ yön miyl ği im ö n m şi l ik öğ n il inin m p ik ğilim v becerilerinin incelenmesi. *Cumhuriyet Üniversitesi Hemşirelik Yüksek Okulu Dergisi*, 9 (2), 11-17.

Maneekhao, K. & Watson Todd, R. (2001). *Two kinds of becoming: The researcher's tale and the mentor's tale*. In Edge, J. (ed). Action research. Alexandria, VA: TESOL.

McDonough, J. (1994). A teache look ' i i . *English Language Teaching Journal*. 48 (1), 57-65.

Okvuran, A. (1993). *Yaratıcı drama eğitiminin empatik beceri ve empatik eğilim düzeylerine etkisi.* Y y m l nm m ş yük k li n zi , Ank Üniv i i , Eği im Biliml i En i ü ü, Ank .

Özb y, Y. v Ş in , M. (2000). Emp ik n f m o f i u um ölç ği ç lil ik v üv n i lik ç l şm . *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 19, 104-113.

Perry, W. G. (1968). *Form of intellectual and ethical development in the college years*. New York, NY: Holt, Rinehart and Wiston Inc.

R b , E. v A , M. (2009). İlköğ i m ikin i k m öğ n i l inin m p ik ğilim ü z y l in ö ç şm çözm v n şl n n in l nm i . *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 18 (1), 323–342.

Ro , C. R. (1983). Emp i : n un p p i w y of b in (in p : Fü un Akkoyun). *Journal of 33. Education Faculty of Ankara University*, 16 (1), 103-124.

Sarmusak, D. (2011). *İlköğretim öğrencilerinin empatik eğilimleri ve algıladıkları öğretmen tutumlarının öğrencilerin ahlakî değer yargılarına etkisi*. Y y m l nm m ş yük k li n zi, G zi Üniv i i, Eği im Biliml i En i ü ü , Ank .

Thornbury, S. (1991). Watching the whites of their eyes: The use of teaching practice logs. In *English Language Teaching Journal*. 45 (2), 140-146.

Uğu , A. (2007). *Oluşturmacı sosyal bilgiler öğretiminde örnek olay incelemesi tekniği kullanımının öğrencilerin empatik düşünme becerilerine etkisi: Bir eylem araştırması*. Y y m l n m m ş yük k li n zi , M m Üniv i i, Eği im Biliml i En i ü ü, İ nbul.

Ural, N. S. (2010). *İlköğretim öğrencilerinin demokratik tutum ve empatik eğilim düzeylerine sosyal bilgiler dersinin etkisi*. Y y ml nm m ş yük k li n zi, k y Üniv i i, o y l Biliml En i ü ü, Eği im Biliml i Bölümü, k y .

Uy oğlu, B. (2011). *Üstün yetenekli ve normal gelişim gösteren ilköğretim öğrencilerinin empati becerileri ve duygusal zeka düzeyleri ile anne-baba tutumları arasındaki ilişkinin incelenmesi*. Yay ml nm m ş yük k li n zi , H p Üniv i i , ğl k Bi liml i En i ü ü, Ank .

Y p , M. & Y p , Ş. (2004). Öğ m n yl n n Okul D n yim i l in ilişkin ö üşl i. *İlköğretim Online*, 3(2), 54-59.

Y l m , İ. (1992). P ikolojik n şm v b lik p o m öğ n il i il p ikoloji p o m öğ n il inin mp ik ğilim v m p ik b i ü z y l i. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, 7, 193-208.

Y lm z, A. (2009). *Suça yönelmiş ve yönelmemiş 14-18 yaş arası ergenlerin empati düzeylerinin ve ana-baba tutumlarının incelenmesi*. Y y ml nm m ş yük k li n zi, Ulu ğ Üniv i i , o y l Biliml En i ü ü, Eği im Biliml i Bölümü, Bu .

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ISRES Publishing

The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9 Pages 127-133

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

The Effect of Storylines Embedded within Context Based Learning Approach on Grade 10 Students' Achievement of Mixtures Unit

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Abstract: The purpose of the present study was to investigate the effect of storylines embedded within the context-based learning approach on grade 10 students‟ achievement of the mixtures unit and attitudes towards chemistry. Within a quasi-experimental design, the study was conducted with conducted with 48 10th grade students drawn from two intact classes in a high school. One of classes was randomly assigned to experimental group and the other to control group. The experimental group was exposed to the context-based materials, while the control group was taught with the traditional approach (teacher‟s explanation, question and answer, writing, etc.). The teaching intervention which took a couple of classroom hours (2x45 minutes; 8 weeks) in the experimental group was designed to actively engage the students in the context based learning. *The Mixtures Unit Achievement Test (MUAT) and Chemistry Attitude Scale (CAS)* were used to collect data. *MUAT* with ten open-ended items was constructed by the authors. The results of this study indicated that the use of storylines embedded within the context-based learning approach resulted in the students in the experimental group performing better with respect to understanding concepts in the mixtures unit. Some suggestions are made on implications for practice and learning.

Keywords: Context-based learning approach, Mixtures unit, Attitude, Chemistry

Introduction

Learning is not an isolated activity from the outside world, but a social activity influenced by everyday contexts (Finkelstein, 2001). However, the learning activity that is attempted to be realized in schools is confronted as a process that is completely abstracted from the outside world, schools are considered to be the places where only the theoretical knowledge is given and the more you solve test the better student you are is the predominant logic.

This situation has led students to not be able to relate the information they learned in school to their own lives, to fail to adapt their knowledge to out of school life, so that results in a profound gap between school and everyday life. In order to fill this gap between the daily lives of the students and the school lessons, it is necessary for the students to be informed about the conscious of interpreting the topics they learn in daily life (Koçak, 2011).

The goal in science education is to ensure that students acquire the scientific attitudes and mental process skills required to solve problems related to science that they may encounter throughout their lives to the extent that they are capable (Ulusoy, 2013). When we draw more attention to it, the secondary chemistry program aims to raise awareness of chemical concepts and principles that affect their lives (MONE, 2007). With this in mind, new approaches have been developed for students to adapt the scientific knowledge they have learned at school to the solitions of the problems they encounter and thus to achieve their predicted skills (Fensham & Harlen, 1999; Bayrak & Erden, 2007). Context based learning is also one of these approaches.

The context-based learning approach is concerned with associating science with events that students encounter in their daily lives and expressing science in a social context (Demircioğlu, 2008). The aim of this approach is to increase the students' desire to learn science, their attitudes and their motivation by presenting scientific concepts through selected contexts in everyday life (Barker & Millar, 2000, Demircioglu, Demircioğlu & Çalık, 2009, Özay-Köse & Çam-Tosun, 2011). In studies conducted for this purpose, it was concluded that it made positive developments to the attitudes and behaviors of the students in general, and that students found it quite interesting and entertaining (Ramsden, 1997, Reid, 2000, Demircioğlu, Vural & Demircioğlu, 2012, Demircioğlu, Bektaş & Demircioğlu, 2018).

Context-based learning approach makes the learned knowledge a necessity starting from a daily life event or problem, and thus aims to use concepts and associations as a tool to solve these events and problems (Acar & Yaman, 2011). In this respect, it also contributes to the constructing of students' minds on the basis of the need to know concepts (Demircioğlu, Demircioğlu & Çalık, 2009, Ültay, Durukan & Ültay, 2017) as well as the answer to the question "Why should I learn this? (Bulte, Westbroek, De Jong & Pilot, 2006, Pilot & Bulte, 2006, Box, 2011). With context-based learning, students make it easier to understand existing situations and identify them connecting events, phenomena and situations one another in everyday life (Yıldırım & Gültekin, 2017). The narratives involved in this approach relate the theoretical knowledge with the real world (Bennett & Lubben, 2006). These narratives are used to communicate ideas, make meaningful ideas, and present the content of the curriculum (Banister & Ryan, 2001; Millar & Osborne, 1998). Students‟ understanding of concepts may develop as they discover by means of narratives (Demircioğlu, 2008), and thus narratives constitute an important awareness for viewing events of daily life from the chemistry aspect.

The purpose of the present study was to investigate the effect of narratives embedded within the context-based learning approach on grade 10 students‟ achievement of the mixtures unit. Within this aim, the following research questions are specifically explored:
1. Do the narratives embedded within the context-based learning approach cause a statistically significant change in students‟ achievement on the mixtures unit?
2. Do the narratives embedded within a context-based approach cause a statistically significant improvement in the students‟ attitudes towards chemistry?

Method

Participants

Within a nonequivalent pretest-posttest control group design, the study was conducted with 48 10th grade students (whose ages were 15-17 years old) drawn from two intact classes in a fine arts high school in Ordu. The experimental (with 25 students) and the control groups (with 22 students) were randomly assigned to them. The students in the two groups had similar educational and socio-economic backgrounds.

The experimental group was exposed to the context-based material, whilst the control one was taught with the traditional approach (teacher‟s explanation, question and answer, writing, etc.).The traditional instruction in the school was strongly based on the teacher centered format. In this format, students were passively listening, writing notes and reading textbook material. The topics and acquisitions in the Mixtures unit are given in Table 1.

Table 1. The topics and acquisitions in the Mixtures Unit

Topics	Acquisitions
Homogeneous Mixtures **Heterogeneous Mixtures**	1- Mixtures which are encountered in daily life are classified according to different qualities. a. How homogeneous and heterogeneous mixtures are distinguished is handled. b. Heterogeneous mixtures are classified according to dispersing medium and the physical state of the dispersing medium. c. Mixtures are classified by size basis. d. The difference of solution from other blends is emphasized.
Coligative Properties	2- It interprets the properties of the solutions related to everyday life, a. It is stated that the solubility is different from those of the solvents such as freezing / boiling point and osmotic pressure, and that the difference grows as the concentration increases (no entry dropping off the vapor pressure) b. It addresses some studies on measures against icing on roads and on vehicles. c. The prospect of using serum (lifesaving solutions) instead of drinking water for water-losing individuals is associated with osmotic pressure.
Separation of	3- it explores the separation techniques used in industry and health areas.

Mixtures	**a.** Separation techniques such as particular size, boiling point, forming filtration, dialysis, distillation and phase utilizing from density difference are processed. **b.** The discovery of the coagulation method used in water refinement is provided. **c.** Ion exchange systems used for softening hard waters are introduced

Data Collection

The Mixtures Unit Achievement Test (MUAT)

A test consisting of 10 open-ended items was developed by researhers. To confirm content validity, the MUAT was examined by a group of experts comprising four university chemistry educators and five high school chemistry teachers who have been teaching for over ten years at the central lycees in the city of Trabzon and Ordu. The MUAT were piloted with thirty-four grade 10 students to check its readability and understandability. Then, some minor revisions were made in the light of the results of the pilot study to produce their final versions. In the MUAT, each correct response (choice) was marked with 10 point, while each incorrect one was scored with zero point. Thus, for the MUAT the maximum score was 100 points.

Chemistry Attitude Scale (CAS)

A 12-item scale developed by Cheung (2009) as a result of a comprehensive study and adapted to Turkish by Şenocak (2011) was used as attitude scale in the study. This scale is an attitude scale developed for high school students covering 16-19 age range. The Cronbach alpha reliability coefficient of attitude scale was calculated as 0,88 by Şenocak (2011). The scale consists of four dimensions: liking theoretical chemistry lessons, liking chemistry labs, evaluating beliefs about school chemistry, and behavioral trends toward learning chemistry. There are no negative expressions on the scale. Since some researchers have suggested that negative materials written as the opposite of positive materials may cause an artificial factor (Schmitt & Stults, 1985, Pilotte & Gable, 1990; Miller & Cleary, 1993), they did not use negative substances on the scale to prevent this artificial factor from forming. The grading of the scale varies from 1 to 7. The highest score that can be taken from attitude scale is 84, the lowest score is 12.

Data Analysis

The results of the pre-test, post-test, and the chemistry attitude scale were compared using independent *t* tests.

The Intervention

To identify students‟ achievement of the mixtures unit and to identify students‟ attitudes towards chemistry, the MUAT and CAS, as a pre-test, was administered to both groups a week before the intervention. The students in the control group were exposed to a teacher-centered approach, which includes the teacher‟s explanations, students taking notes and referring to the textbook for examples and illustrations.

In the experimental group, the context-based learning material (CBTLM) was used to teach the topic of Change of States. The material for 8 weeks (2x45 minutes; two lessons per week) was designed to actively engage the students in the context based learning. Each lesson plan consisted of a storyline and related activities (i.e., pictures, virtual laboratory work, worksheets, discussing). The storylines „My Mother and Her Kitchen (Story 1), Black Winter (Story 2), and My Summer Vacation (Story 3)‟ were prepared by the authors. One of the storylines is given in Appendix 1. Lessons are conducted by the second author of the study.

The authors preferred the teaching model developed by King (2009) for the context-based learning approach. The teaching and learning sequence of each lesson had the following pattern: start with a context, investigate a solution through a context-based problem, identify the heat concepts within the context and apply these concepts to new contexts.

1. *Start with a context*: Each lesson started with a context to focus student attention. The context was set to probe student prior knowledge and understanding at the beginning of a lesson. Student prior knowledge was elicited through brainstorming, discussion or testing intended to help students see how the science concept related to their lives and experiences. At this stage, the storylines prepared by authors were used.

2. *Investigate a solution through a context-based problem*: Students were encouraged to answer the questions or solve problems that they faced in step 1 through experiments, demonstrations, reading assignments, group and class discussions of reading assignment, and/or by working through examples or exercises. At this stage, the students made experiments on the subject in the virtual environment (URL, 1) and answered the questions about the concepts in the experiments. Experimental topics are; homogeneous and heterogeneous mixtures, separation of liquid mixtures by boiling point difference, separation of solid two substances by solubility difference, filtration of cloudy water, separation of solid two substances by density difference, freezing point descent and osmotic pressure.

3. *Identify concepts through the context*: The teacher encouraged students to report the results of their investigations back to the class, to discuss and make summaries of homogeneous mixture, heterogeneous mixture, osmotic pressure, separation of mixtures, freezing point descent, etc. concepts. At this stage, the students prepared concept maps related to the subject and performed activities with the diagnostic tree technique of the concepts. They shared the results of their work with their friends.

4. *Apply concepts to new contexts*: Students were presented with at least one new context which linked to the concepts they had learned and were asked to explain the new contexts. The students searched the related daily life topics (such as What is antifreeze? What is the anti-freeze on the car radiator?; Why isn't the water given to the patient suffering from water loss directly but why is serum given ? What could be the reason for this?; How did the travertine form?) and presented them with their classmates.

Results and Discussion

Pre-MUAT scores and pre-CAS scores for the experimental and the control groups are presented in Table 2, which shows that they have very close mean scores and standard deviations. The independent *t*-test indicated that there was no statistically significant difference between the mean scores of the groups with respect to the previous understanding of Mixtures Unit‟s concepts ($t_{(45)}$=0,681, p>0,05; Table 2). Similarly, there was no statistically significant difference between the mean scores of the groups with respect to students‟ attitudes towards chemistry ($t_{(45)}$=0,106, p>0,05; Table 2). These results indicate that students in the experimental group were very similar to those in the control one in regard to these two variables.

Table 2. The results of the *t*-test on pretest scores of students in the experimental and the control groups

Test	Group	N	Mean	SD	*df*	*t*	*p*
Pre-MUAT	EG	25	13,520	12,018	45	0,681	0,501
	CG	22	11,773	11,197			
Pre-CAS	EG	25	39,920	12,952	45	0,106	0,916
	CG	22	39,500	14,138			

After the intervention, the results of the independent *t* test showed that there was both a significant difference between the experimental and control groups with respect to students‟ achievement of mixtures unit ($t_{(45)}$=6,175, p<0,05; Table 3), and also with respect to the chemistry attitude scale ($t_{(45)}$=2,872, p<0,05; Table 3). This finding revealed that the students in the experimental group taught with the context-based approach exhibited significantly greater chemistry achievement than those in the control group on the post-tests. Since the only independent variable was the intervention, it can be concluded that this difference may have resulted from the context based learning approach. That is, as if the traditional instruction helped students to improve their conceptions of the mixtures unit‟ concepts to some extent, their retention was very lower than that of the experimental one. Developed materials and contexts related to everyday life have attracted the attention of students and may have given them a more relevant approach to the subject. It can be said that the use of contexts related to everyday life in the context-based learning approach allows the learned information to be remembered better, which in turn increases academic achievement.

Table 3. The results of the *t*-test on posttest scores of students in the experimental and the control groups

Test	Group	N	Mean	SD	df	*t*	*p*
Post-MUAT	EG	25	63,800	13,026	45	6, 175	0,000
	CG	22	40,136	13,203			
Post-CAS	EG	25	53,320	13,704	45	2,872	0,006
	CG	22	42,272	12,506			

Conclusions and Implications

When the final test scores of the experimental and control groups were examined, it was found that there was a significant difference in the Mixtures Unit Achievement Test (MUAT), Chemistry Attitude Scale (CAS) scores in favor of the experimental group. In this case, it can be said that the study based on context-based learning is effective on both sides. This result is consistent with studies reporting that students taught with the context-based learning approach have a better understanding of the concepts from the students taught with a more traditional approach(Demircioğlu, 2012, Çiğdemoğlu & Geban, 2015, Ayvacı, Nas & Dilber, 2016, Demircioğlu, Aşık & Yılmaz, 2017;).

The context-based activities used in the lessons, especially the narratives are found interesting by the students, students have been seen more motivated and they liked the lessons. It is thought that the interest of the students to the lectures is increased as they have learned by doing and experiencing and they are aware of the learned items as a tool of their life. When the literature is examined, it is concluded that after the lessons in which the context-based learning approach is used, the students have liked the process, performed permanent learning (Demircioğlu, Vural & Demircioğlu, 2012; Ültay, Durukan & Ültay, 2015) and real-life associations facilitate students to understand concepts (Choi & Johnson, 2005; Demircioğlu, Vural & Demircioğlu, 2012; Demircioğlu, Ayas, Demircioğlu & Özmen, 2015; Elmas & Geban, 2016; Karslı & Yiğit, 2017). It has also been reported by many studies that the interest and success have changed in parallel (Koçak & Önen, 2012; Tay & Akyürek Tay, 2006). In this respect, the context-based learning approach emerges as a way of responding to the needs of the students. The obtained data also supports this situation.

The stories should be used as a starting point to teach the concepts of chemistry, and the concepts that students have difficulty to understand should be taken into consideration when preparing the stories. The stories should be appropriate for the students and motivate them to study on the concepts of chemistry.

This study has been applied at Fine Arts High School. Because of the prejudice of inability of the learners and their perspective on Cultural Lessons the learning of the students is incomplete no matter how effective the course is. This study is applicable to different schools and the study results can be comparable.

References

Acar, B. & Yaman, M. (2011). The effects of context-based learning on students‟ levels of knowledge and interest. *Hacettepe University Journal of Education,* 40, 1-10.

Ayvacı, H. Ş., Er Nas, S. & Dilber, Y. (2016). Effectiveness of the context-based guide materials on students‟ conceptual understanding: "conducting and ınsulating materials" sample. *YYU Journal of Education Faculty,* 13(1),51-78.

Barker, V. & Millar, R. (2000). Students‟ reasoning about basic chemical thermodynamics and chemical bonding: what changes occur during a context-based post-16 chemistry course?. *International Journal of Science Education*, 22(11), 1171- 1200.

Bayrak, B. & Erden, A. M. (2007). The evaluation of science curriculum (Fen bilgisi öğretim programının değerlendirilmesi). *Kastamonu Education Journal,* 15(1), 137-154.

Bulte, A. M. W., Westbroek, H. B., De Jong, O. & Pilot, A. (2006). A research approach to designing chemistry education using authentic practices as contexts. *International Journal of Science Education, 28*(9), 1063-1086.

Cheung, D. (2009). Developing a scale to measure students‟ attitudes toward chemistry lessons. *International Journal of Science Education*, 31(16), 2185-2203.

Choi, H. J., & Johnson, S. D. (2005). The effect of context-based video instruction on learning and motivation in on-line courses. *The American Journal of Distance* Education, 19(4), 215-227.

Çiğdemoğlu, C. & Geban, Ö. (2015). Improving students‟ chemical literacy levels on thermochemical and thermodynamics concepts through a context-based approach. *Chemistry Education Research and Practice,* 16, 302-317. DOI:10.1039/C5RP00007F

Demircioğlu, H., Ayas, A., Demircioğlu, G., & Özmen, H. (December, 2015). Effects of storylines embedded within the context-based approach on pre-service primary school teachers‟ conceptions of matter and its states, *Asia-Pacific Forum on Science Learning and Teaching*, 16(2), Article 4.

Demircioğlu, H., Bektaş, F. & Demircioğlu, G. (2018). The effect of teaching of topic of properties of liquids with context based approach on students‟ achievement. *Dicle University Journal of Ziya Gökalp Faculty of Education*, in press.

Demircioğlu, H., Demircioğlu, G., & Çalık, M. (2009). Investigating effectiveness of storylines embedded within context based approach: the case for the periodic table. *Chemistry Education: Research and Practice*, 10, 241-249.

Demircioğlu, H., Vural, S. & Demircioğlu, G. (Aralık, 2012). The effect of a teaching material developed based on "REACT" strategy on gifted students‟ achievement. *Ondokuz Mayıs University Journal of Education Faculty,* 31(2), 101-144.

Demircioğlu, H., Aşık, T. ve Yılmaz, P. (21-24 May, 2017). Effectiveness of the REACT strategy on students‟ conceptual understanding: „Water treatment and water hardness‟. *1st Eurasian Conference on Language and Social Sciences (ECLSS)*, Antalya, Turkey.

Elmas, R. & Geban, Ö. (2016). The effect of context based chemistry ınstruction on 9th grade students‟ understanding of cleaning agents topic and their attitude toward environment. *Education and Science*, 41(185), 33-50. DOI: 10.15390/EB.2016.5502

Fensham, P. J. & Harlen, W. (1999). School science and public understanding of science, *International Journal of Science Education*, 21(7), 755-763.

Karslı, F. & Yiğit, M. (2017). Effectiveness of the REACT strategy on 12th grade students‟ understanding of the alkenes concept. *Research in Science & Technological Education*, 1-18. DOI: 10.1080/02635143.2017.1295369

Koçak, C. (2011). *Evaluation of chemistry topics within the daily life concept.* Doctoral Thesis, Hacettepe University Graduate School of Natural and Applied Sciences, Ankara.

Kocak, C. & Önen, A. S. (2012). Evaluation of chemistry topics within the daily life concept. *Hacettepe University Journal of Education,* 42, 262-273.

Kutu, H. (2011). Teaching "Chemistry in our lives" unit in the 9th grade chemistry course through context-based ARCS instructional model. Doctoral Thesis, Ataturk University Institute of Educational Sciences, Erzurum.

MONE (MEB). (2007). Secondary school 9th year chemistry course curriculum (Ortaöğretim 9. sınıf kimya dersi öğretim programı). Ankara.

Özay-Köse, E. & Çam-Tosun, F. (2011). Effect of "context based learning" in students‟ achievement about nervous system. *Journal of Turkish Science Education*, 8(2), 91-106.

Pilot, A. & Bulte, A. M. W. (2006). The use of "contexts" as a challenge for the chemistry curriculum: its successes and the need for further development and understanding. *International Journal Science Education,* 28(9), 1087 -1112.

Şenocak, E. (2011). A study on adaptation of the attitudes toward chemistry lessons scale into Turkish. *Journal of Turkish Science Education*, 8(2), 114-129.

Ulusoy, F. M. (2013). *Effect of generative learning model integrated with context-based learning on students' attitude, motivation and achievement towards chemistry teaching.* Master's Thesis, Hacettepe University Graduate School of Science and Engineering, Ankara, Turkey.

Yıldırım, G., & Gültekin, M. (Nisan, 2017). Applications of context-based learning in primary 4th class science and technology course. *Ahi Evran University Journal of Kırşehir Education Faculty*, 18, Special Issue, 81-101.

Tay, B. & Akyürek Tay, B. (2006). The effects of attitude on success in social sciences courses. *The Journal of Turkish Educational Sciences,* 4(1), 73-82.

URL 1, http://f.eba.gov.tr/sanlab/index.html

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Appendix 1 One of the storylines used in the study

My Mother and Her Kitchen

Ayşe is a hardworking, intelligent student who observes the environment very well. After reading the book, the thing she likes most is to help his mother at home. Ayşe told the day she lived with her mother in the kitchen.

When I came home from school, my mother was boiling milk in the kitchen. She did not leave from the oven for a moment. Then she was going to ask me how my day went. Milk suddenly flooded. At that moment, the question came up to my mind, "Why does the milk overflow from the pan when it is about to boil?"

Our guests would come last week. My mom made a very tasty and famous tie dessert. She did pour 2.5 cups of sugar into 2 cups of water in front of my eyes! I was shocked. 2.5 cups of sugar almost disappeared. How did this happen? Could a hocus pocus be? :)

What about the Russian salad? When so many ingredients come together such as pickles, peas, carrots, potatoes, corn, and of course mayonnaise and yogurt, it becomes so delicious! My mother says it a magic mixture. Do you think how is the mayonnaise made? Why don't we see the things in mayonnaise.

My mom made me a quick sandwich because I was so hungry. What was't there in it? Cheese, salami, tomato, pickle, lettuce ... Ahh it was super! And it would be better if I could taste them all in the same bite. A different food was coming into my mouth in each bite. How can we explain this situation?

I left the kitchen saying whom I could learn the answers of these questions and I headed towards my room.

Come on!
Let's help Ayşe.
What do you say?

The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS),2018

Volume 9, Pages 134-142

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

The Effectiveness of Metacognitive Prompts on a Genetics Test among High School Students in Kenya

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Abstract: This study investigated the effectiveness of using metacognitive prompts in improving scores on a genetics test among high school students in Western Kenya. The study, a post-test only control group quasi-experimental design involving 2x2x3 factorial matrix also investigated the interacting effects of metacognitive prompting and self-efficacy beliefs while controlling for gender. A total of 2,139 form four (grade 12) students from intact classes participated in the study that was carried out in 17 high schools. Three validated instruments: Metacognitive Prompting Questionnaire (MPG), Self-efficacy Questionnaire (SEQ) and Genetics Test (GT) were used for data collection. Data were analysed both descriptively (means and standard deviation) and inferentially through a 2x2x3 Analysis of Covariance (ANCOVA). Findings showed that testing method(Metacognitive prompting Versus Conventional) and self-efficacy beliefs had statistically significant main effects on students genetics test score ($F(1,2132) = 4.568$, $p = 0.033$) and (F $(1,2132) = 963.740$, $p < 0.001$) respectively. This implied that use of metacognitive prompts had superior effects to conventional method of testing. It also implied that students who are highly efficacious do better on tests than students with low self-efficacy. There were no significant 2-way and 3-way interaction effects of variables on genetics test score. These findings have implications for Biology teachers who are implored to adopt the use of metacognitive prompts during testing and to promote self-efficacy beliefs among students.

Keywords: Metacognitive prompts, Self-efficacy, Genetics, Testing

Introduction

One of the main objectives of science education is to help students to become independent, autonomous, efficient and life-long learners (Donnelly 2010; Kozma 2013; Kuo et al. 2013). According to Watkins (2001), to promote learning one has to make learning explicit and to bring learning itself to consciousness. To achieve this, many, educators and psychologists have long promoted the effective role of cognitive and metacognitive strategies in teaching and learning. Learning in science involves various cognitive processes required in problem solving, inquiry learning, reading and writing (More & Hill 2002; Veenman 2012). To improve science education it is imperative to develop learners' metacognitive awareness by guiding them to be responsible for their own learning through being able to plan, monitor and evaluate their learning (Chiu 2007; Sandi-Urena,Cooper& Stevens 2011;Zohar & Barzilai 2013).

Certain aspects of learning such as problem solving, critical thinking and self-directed learning are critical for preparing students for higher education and career (Donnelly 2010; Fisher 2011; Lai 2011). A host of research have shown that meaningfulness of learning can be empowered by metacognition (Collins 2011; Lai 2011; Ozsoy & Ataman 2009; Schraw & Dennison 1994). Conceptualisation of metacognition over the past three decades by researchers (Balcikanli 2011; Flavell 1979; Schraw 1998; Schraw & Dennison 1994; Thomas, Anderson & Nashon 2007; Veenman 2012) highlights the interrelationships of metacognitive knowledge and skills (Veenman et al. 2006). Metacognition includes the metacognitive skills which are denoted to as ―executie or self-regulatory processes" (Veenman 2012, p.21). Several metacognitive strategies empower metacognitive knowledge and skills in science education like prompted reflection questions (metacognitive prompting), modeling, thinking aloud, metacognitive scaffolding and self-questioning (Du Toit 2013; Haidar & Al Naqabi 2008; Ku & Ho 2010; Mevatech & Fridkin 2006; Parsons 2011).

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

Metacognitive Prompting

Metacognitive prompting‘ is defined as ―anexternally generated stimulus that either tacitly or explicitly activates reflective cognition or evokes strategy use with the objective of enhancing a learning or problem solving objective" (Hoffman & Spatariu 2008, p.878). Metacognitive prompting has been proved as effective in enhancing students‘ self-efficacy and problem solving efficiency in science and mathematics (Collins 2011; Hoffman & Spatariu 2008). Prior studies have revealed the inclusion of metacognitive prompts during assessments resulted in superior problem solving performance (Hoffman & Spatariu, 2008; Kramarski & Gutman; 2006). Hoffman & Spariatu, (2008) showed that metacognitive prompting promoted both accuracy and efficiency in problem solving for students in math classes. Endorsing ―prompted metacognitive reflections" (Collins 2011, p.39) by asking students reflective questions as they work their way through learning, triggers their reflective cognition and helps to connect their learning experience and content knowledge to unfamiliar contexts (Collins 2011; Davis 2003; Hoffman & Spatariu 2008; Wiezbicki-Stevens 2009). According to Berthold, Nückles & Renkl (2007) cognitive and metacognitive prompts empower students‘ learning especially when metacognitive and cognitive prompts are combined. Prompting has been used to get students to think, review and reflect before, in or after the lesson to deepen understanding and comprehension (Fogarty 2006, p.8). Self-reflection questions and comments by naming and describing while learning help the students to better understand when there is any difficulty, their reflective cognition and helps to connect their learning experience and content knowledge to unfamiliar contexts (Collins 2011; Davis 2003; Hoffman & Spatariu 2008; Wiezbicki-Stevens 2009). Metacognition does not influence learning outcomes when it is isolated but rather is related to other elements of learning theory such as self efficacy (Veenman 2012).

Metacognition and Self-efficacy

Research has shown a relationship between metacognitive awareness, self-efficacy, self-regulation and learning processes (Lai 2011; Veenman, Van Hout-Wolters & Afflerbach 2006). Students‘ metacognitive awareness and the metacognitive strategies that they use in learning processes are subsets of self-regulation such as self-efficacy, where the learner‘s self-confidence about performance and goal attainment influence the learning outcomes (Lai 2011; Schraw, Crippen & Hartley 2006). The role of student‘s self-efficacy in empowering academic outcomes has been proven where students with high level of self-efficacy often persevere longer with tasks, and are more likely to set and monitor their goals (Bandura 2006; Collins 2011; Britner & Pajares 2006; Zimmerman & Cleary 2006). While metacognitive awareness plays significant role in self-regulated learning, self-efficacy is important to help the learners to have the belief that they can perform tasks an achieve goals (Zimmerman & Cleary 2006). The learners with less successful strategies are the individuals that have low level of self-efficacy (Collins, 2011). Self-reflection on performance is the last stage of self-regulation where the learner evaluates the extent of their satisfaction about performance outcomes and it is found that self-efficacy plays a crucial role at this stage because it influences the learners‘ abilities to judge their task performance and goal achievement (Collins 2011, p.28). In this light, teacher‘s feedback to students increases their self-efficacy(Zimmerman & Cleary 2006). What leads to the empowerment of learners‘ self-efficacy is the goal achievement coupled with the cognitive processing that is required to achieve the targeted goal (Collins 2011, p.37).

Although several studies investigated the role of metacognition in teaching and learning, the effect of implementing certain metacognitive strategies such as metacognitive prompting in specific tasks such as testing has not explored deeply and openly in the literature (Lai 2011; Zohar & Barzilai 2013). In addition,few studies have explored the effect of metacognition on academic outcomes among high school students. The current study investigated the effectiveness of metacognitive prompting in a problem solving task measured through a genetics test and its interactive effects with self-efficacy. Gender was controlled for since gender differences seem to play a role in the level of the student‘s self-efficacy, although literature review indicated inconsistent results (Zimmerman & Martinez-Pons 1990; Jacobs et al. 2002). A study by Pajares (2003) concludes that although grade nine female students obtained better writing scores, the male students showed a higher level of self-efficacy than the female students. Another study (Zimmerman & Martinez-Pons 1990) indicates that there is no significant difference in self-efficacy in mathematics between male and female students while Jacobs et al. (2002) concludes that female students have higher self-efficacy than males from kindergarten through grade twelve in mathematics. The purpose of this study was to investigate the effectiveness of metacognitive prompts in a genetics test among high school students in kenya.

Method

Research Design

This study used a randomized control group quasi-experimental research design involving 2x2x3 factorial matrix with gender serving as a covariate. The design involved a full factorial model that investigated the main effects of the experimental treatment (metacognitive prompting), gender, and self-eficacy beliefs on genetics problem solving. Quasi-experimental design was appropriate for this study because randomly assigning individual participants to experimental and control conditions was impossible due to the nature of pre-existing intact classes of students (Johnson & Christensen, 2004). Seventeen high schools in Kenya agreed to participate in the study. From those schools, classrooms were randomly assigned to the experimental and control conditions by a member from each class drawing a ‗YES' or a ‗NO' token from a hat. Students in the ‗YES classes' were assigned to the experimental group while those in ‗NO classes ' were assigned to the control group. The result was two equivalent groups of students in the experimental and control conditions drawn from each school. Genetics instruction for both groups conformed to standards included in the national curriculum. The experimental group received metacognitive prompts embedded in their genetics test, while the control group received their test without any metacognitive prompting.

Participants

A total sample of 2,139 form four (12^{th} grade) was purposively selected from a population of approximately 4,000 form fours, from 17 high schools in Western region of Kenya. This was because genetics is taught at form four level (grade 12).There were n= 1070 (50.03%) males and n= 1069 (49.97%)females based on the current demographics of the school then.

Data Collection

In addition to providing individual demographic information, students in the study completed three validated instruments: Metacognitive Prompting Questionnaire (MPG), Self-efficacy Questionnaire (SEQ) and Genetics Test (GT) were used for data collection

Metacognitive Prompting Questionnaire

Metacognitive Prompting Questionnaire was a 14-item questionnaire. The metacognitive prompts, included comprehension questions, strategic questions, reflection, and connection questions, to be completed during the problem solving tests. Two comprehension questions were designed to encourage students to reflect on a problem before solving it. Four strategic questions were designed to encourage students to think about what strategy might be appropriate for the given problem and to provide a reason or rationale for that strategy choice. Four reflection questions were designed to foster self-monitoring, self-explaining, and self-evaluation in the problem solving process. Finally, four connection questions were designed to encourage students to identify and recognize deep-structure problem attributes so that they could activate relevant strategy and background knowledge. In terms of performance for the different types of MP, strategic MPs tended to perform better than the rest with a cronbach's alpha of 0.76, followed by reflection MPs with an overall alpha of 0.74, then comprehension with alpha of 0.72 and finally connection MPs with alpha of 0.69.

Self-Efficacy Questionnaire (SEQ)

A Self-efficacy Questionnaire was used to measure students' self-efficacy beliefs about their genetics problem solving ability. This questionnaire is a modified version of the Self-efficacy and metacognitive Learning Orientation Inventory- Science (SEMLI-S) developed by Thomas., Anderson, & Nashon, (2007) and used in assessing the self-efficacy beliefs of students in science. The SEQ was developed by the researcher by modifying items from three sub-scales of Self-Efficacy and Metacognition Learning Inventory—Science (SEMLI-S) to make it applicable to the study population and relevant to the research questions. SEMLI-S is a valid and reliable tool for investigating high school students' self-perceptions of elements of their metacognition, self-efficacy and science learning processes. Modification of existing assessment instruments and outcome measures is common practice; this frequently occurs to render a measure more closely suited to the specific purposes and environment for which it is intended and such that it answers the specific questions it is intended to answer (Kazdin, 1999). According to Kazdin (1999). such adaptations, when relevant to a particular setting, are justifiable insofar as the changes are necessary. This modified version was named Self-efficacy Questionnaire (SEQ) with three sub scales, science self efficacy (SSE), self regulation (SR), and constructivist connectivity (CC). Internal consistency for the modified scale in the current sample was above the acceptable levels: Science self-efficacy, α=0.873; Self-regulation, α=0.922; Constructivist Connectivity, α=0.917; Overall Self-efficacy scale, α=0.946. The final instrument had 25 items on a 5-point Likert-type scale: *1 = Strongly Disagree (SD); 2 = Disagree (D); 3 = Uncertain (UN); 4 = Agree (A); and 5 = Strongly Agree (SA)*

Genetics Problem Solving Test (GPST

The Genetics Problem Solving Test (GPST) was an 18-item classroom assessment focused on solving problems from the domain of genetics. The questions fit within HS-LS3 in the NGSS (National Research Council, 2013). Both face and content validity were achieved through expert review using same experts as those for BAT. The rater‘s report for GPST indicated that the items were rated relevant, with the mean rating ranging from 2 (relevant) to 3 (highly relevant).The overall mean rating was 2.83 on a scale of 1 to 3. There were two forms of the GPST, which served as the intervention under investigation in this study. The Metacognitive Prompting Questionnaire (MPQ) is a 14-item survey with reliability co-efficient of 0.78. The 14 items were embedded in the GPST for experimental group; serving as an intervention. Details of MPQ are found in the next section.

Data Analysis

Data were analysed both descriptively (means and standard deviation) and inferentially through a 2x2x3 Analysis of Covariance (ANCOVA).

Results and Discussion

Results and discussion of findings are presented in this section. Data were analyzed both descriptively (means and standard deviation) and inferentially using a 2x2x3 Analysis of Covariance, ANCOVA(between-subjects factor: Test method (Metacognitive prompting and conventional method of testing), Self-efficacy Beliefs(Low, Moderate and High) and a covariate: Gender(Male and female).

Preliminary Findings

Demographics of participants were assessed to ensure almost equal representation by gender and treatment groups. Underlying assumptions for ANCOVA were examined to ensure that the data did not violate them. In addition, to understand the central tendency and variability of the data, descriptive analysis was conducted to give means and standard deviations.

Demographics of Participants

A total of 2,139 participants were involved, with n=1081 in experimental group and n=1059 in control group. There were n= 1070 males and n= 1069 females. These results indicate good enough representation by gender and by treatment groups.

Testing for Assumptions

Assumptions of Normality and homogeneity of variances were assessed through Q-Q plots and Levene's test respectively. Q-Q plots revealed that data were Normally distributed. results of Levene's test were not statistically significant ($F(1,2137)=.001$; $p=.978$). This meant the assumption of homogeneity of variances was not violated and that data were suitable for ANCOVA.

Descriptive Statistics

Table 1 presents descriptive statistics of the variables of interest. Means, standard deviations and sample sizes for respective cells are indicated.

Table 1. Means, standard deviations and sample sizes for genetics test by treatment group and level of self-efficacy beliefs

Level of Self-Efficacy	Group	Mean	Std. Deviation	N
Low	Experimental	11.93	5.687	111
	Control	11.37	4.126	170
Moderate	Experimental	27.54	6.334	917
	Control	26.32	6.590	862
High	Experimental	37.12	2.684	52
	Control	34.89	6.216	27

Results indicate that students in experimental group outperformed those in control group regardless of whether they had low, moderate or high self-efficacy beliefs. The significance of this difference was investigated through inferential analysis. Overall mean for Students' self-efficacy beliefs was M= 74.23, SD= 18.912 with a minimum score of 25 and a maximum of 125; while that for Genetics test was M=25.28, SD=8.376 with minimum score of 2 and maximum of 40.

Primary Findings

Summary of the analysis of covariance is presented in Table 2. This is to explain the hypotheses involving main and interaction effects of testing methods (TM), gender (GEND) and self efficacy beliefs (SEB) on students' Score on Genetics test (SGT)

Table 2. Summary of analysis of covariance on students' genetics test scores according to testing methods, self-efficacy beliefs and gender

Source of Variation	df	F	Sig.	η^2
Main Effects				
TestMeth	1,2132	4.568	.033*	.002
SEB	1,2132	963.70	.001*	.311
GEND	1,2132	1.03	.31	.000
2 Way Interactions				
TestMeth * SEB	5	.32	.57	.000
SEB * GEND	2	.29	.59	.000
TestMeth*GEND	1	.159		.690
3 Way Interaction				
TestMeth * SEB * GEND	1,2132	.12	.73	.000

* means statistically significant at $\alpha = 0.05$

Results in Table 2 reveals statistically significant main effects of testing method ($F(1,2132) = 4.568$, $p = 0.033$, η^2= 0.002) where the students in experimental group did better (*EMM*= 25.466) than those in control group (*EMM*= 24.139). Even though the effect size was weak; η^2= 0.002. This finding may prove to be of minimal practical significance, but does bear some attention in future studies exploring the impact of metacognitive prompting in different academic populations and situations.

There was a statistically significant main effects of self-efficacy beliefs ($F(1,2132) = 963.740$, $p < 0.001$, $\eta^2 = 0.311$) on students genetics test score where students with high SEB outperformed (EMM= 35.892) those with moderate (*EMM*=26.903) and low SEB (*EMM*= 11.613) in that order.

The predicted main effect for gender was not significant ($F(1,2132) = 1.03$ $p = 0.31$, $\eta^2 < 0.001$).

The summary of ANCOVA results of the 2-way interaction effect in Table 2 revealed no significant interaction effect of testing methods and SEB on the students' SGT ($F = 0.32$, $P > 0.05$), hence the Null hypothesis is not rejected. Therefore Testmeth and SEB did not interact to have significant effect on students' SGT. This implies that students' SGT did not differ irrespective of their level of self-efficacy when they are exposed to either the metacognitive prompting or conventional method of testing. This means that none of the treatment conditions was particularly superior over the other for any of the level of self-efficacy.

The summary of ANCOVA results of the 2-way interaction effect in Table 2 revealed no significant interaction effect of SEB and GEND on the students' genetics Test scores in, ($F = 0.29$, $P > 0.05$), hence the Null hypothesis is not rejected. This implies that SEB did not interact with gender to influence students' score on genetics test. In other words, SEB were not differentially effective for any of the gender. This means that with respect to student's gender, the level of self-efficacy beliefs did not have significantly different impacts on genetics test scores.

Similarly, summary of ANCOVA results of the 2-way interaction effect in Table 2 revealed no significant interaction effect of Testmeth and gender on students' score, ($F = 0.514$, $P > 0.05$), hence the Null hypothesis is not rejected. This explains that there was no significant difference in the students' genetics test score based on gender when they are exposed to either the metacognitive prompting or conventional method of testing. In other words, none of the treatment conditions was particularly superior over the other for any of the gender.

The summary of ANCOVA results of the 3-way interaction effect in Table 2 revealed no significant interaction effect of Testmeth, gender and self-efficacy beliefs on students' genetics test scores, ($F = 0.12$, $P > 0.05$), hence the Null hypothesis is not rejected. This by implication explains that testmeth, gender and self-efficacy beliefs do not interact to significantly influence students' score in genetics. The implication is that none of the possible 12 combinations of treatment, gender and self-efficacy beliefs do not work together to influence performance during testing.

Discussion

This study investigated the effectiveness of using metacognitive prompts in improving scores on a genetics test among high school students. The ANCOVA model used in this investigation allowed the control for effects of gender and test for effects of metacognitive prompts during testing and self-efficacy beliefs during a genetics test. The results suggested that metacognitive prompting is beneficial in supporting student performance on the genetics test, regardless of the condition. In addition, students who are highly efficacious did better than those with moderate and low self-efficacy in this sample drawn from Kenyan high school students. The findings are consistent with prior studies that revealed the inclusion of metacognitive prompts during assessments resulted in superior problem solving performance (Hoffman & Spatariu, 2008; Kramarski & Gutman; 2006; Kramarski & Zeicher, 2001). A study by Hoffman & Spariatu, (2008) showed that metacognitive prompting promoted both accuracy and efficiency in problem solving for students in math classes. The results are also consistent with Schraw (1998) who recommended providing explicit prompts to help students improve their regulating abilities. He suggested using a checklist with entries for planning, monitoring, and evaluation, with sub-questions included under each entry that need to be addressed during the course of instruction. Such a checklist, he argued, helps students to be more systematic and strategic during problem solving. Similarly, Schraw et al. (2006) and Schraw (1998) urge educators to provide explicit instruction in cognitive and metacognitive strategies. These results have implications to classroom teachers who can effectively include metacognitive prompts in tests to guide students to activate the problem solving strategies they have learned during their studies

Conclusions

Metacognitive prompting seems to have influenced the performance of students during genetics problem solving test. This finding may prove to be of minimal practical significance owed to the small effect size, $\eta^2 = 0.002$, but does bear some attention in future studies exploring the impact of metacognitive prompting in different academic situations. in addition, self-efficacy seems to have an effect on students' outcomes in a test. These findings lend support to the use of metacognitive strategies in both learning and assessment. It may appear that students who perform well in test apply their metacognitive strategies and are highly efficacious.

Recommendations

Because literature shows that metacognitive prompting leads to meaningful problem solving and with the findings of this study that metacognitive prompting significantly influenced performance on a test, it is recommended that biology teachers should embrace metacognitive prompting strategy and other participatory strategies during testing. Capacity building opportunities and exposure of teachers to metacognitive tasks for updating their teaching skills and techniques are tools for improving problem solving and these are strongly recommended.

Educators should consider infusing MP into instruction as a means to foster self-reflective awareness. Educators should adapt methods to change both student self-efficacy beliefs and implement strategies to overcome limitations during testing. Because of the significant ceffects of sefficacy on testing, it is highly recommended that science educators and teachers make a deliberate attempt to assess the existing levels of self-efficacy in students at classroom level and apply appropriate interventions to low self-efficacious sudents should be taken to help raise their self-efficacy levels through vicarious learning, metacognitive prompting, self-regulated learning, goal setting, among others. A longitudinal study may provide more evidence of the influence of metacognitive prompts on test performance. Future research should investigate other variables that influence performance in testing environments besides metacognitive prompting.

Acknowledgements

I acknowledge support received from teachers and students from sampled schools during the study.

References

Balcikanli, C. (2011). Metacognitive Awareness Inventory for Teachers (MAIT). *Education & Psychology*, vol.9(23), pp. 1309-1332.

Bandura, A. (2006). Guide for constructing self-efficacy scales. In F. Pajares & T. Urdan (eds.).*Self-efficacy beliefs of adolescents*, vol. 5. Greenwich, CT: Information Age Publishing, pp. 307-337.

Berthold, K., Nückles, M., & Renkl, A. (2007). Do learning protocols support learning strategies and outcomes? The role of cognitive and metacognitive prompts. *Learning and Instruction*, vol.17(5), pp.564-577.

Britner, S. L., & Pajares, F. (2006). Sources of Science Self-Efficacy Beliefs of Middle School Students. *Journal of Research in Science Teaching, 43*(5), 485.

Chiu, M. (2007). A national survey of students' conceptions of chemistry in Taiwan. *International Journal of Science Education*, vol.29(4), pp.421–452.

Collins, T. (2011). *Science Inquiry as Knowledge Transformation: Investigating Metacognitive and Self-regulation Strategies to Assist Students in Writing about Scientific Inquiry Tasks*. Ph.D. Dissertation. Oregon State University.

Davis, E. A. (2003). Prompting Middle School Science Students for Reflection: Generic and Directed Prompts. *The Journal of the Learning Sciences*, 12(1), 91-142.

Donnelly, B. (2010). *Digital portfolios and learning: the students' voices*. Ed.D. Thesis. University of California Davis.

Du Toit, D.S. (2013). *The effect of metacognitive intervention on learner metacognition and achievement in mathematics*. Ph.D. Thesis. University of the Free State Bloemfontein.

Flavell, J.H. (1979). Metacognition and Cognitive Monitoring: A New Area of Cognitive Developmental Inquiry. *American Psychologist, 34,* 906-911.

Fisher, A. (2011). *Critical Thinking: An Introduction*. 2nd ed. Cambridge: Cambridge University Press.

Fogarty, E. (2006). *Teachers' use of differentiated reading strategy instruction for talented, average, and struggling readers in regular and SEM-R classrooms*. Ph.D. Dissertation. University of Connecticut.

Haidar, A. & Al Naqabi, A. (2008). Emiratii high school students' understandings of stoichiometry and the influence of metacognition on their understanding. *Research in Science and Technological Education,* vol.26(2), pp.215-237.

Hoffman, B., & Spatariu, A. (2008). The Influence of Self-efficacy and Metacognitive Prompting on Math Problem solving Efficiency. *Contemporary Educational Psychology, 33*, 875-893.

Jacobs, J., Lanza, S., Osgood, D., Eccles, J. & Wigfield, A. (2002). Changed in children's self competence and values: gender and domain differences across grades one through twelve. *Child Development*, vol.73(2), pp.509-527.

Kazdin, A. E. (1999). Overview of research design issues in clinical psychology. In P. C.Kendall, J. N. Butcher, & G. N. Holmbeck (Eds.) *Handbook of Research Methods in Clinical Psychology* (2nd ed., pp. 3-30). New York: John Wiley & Sons.

Kozma, R. (2013). The race to new mathematics of brains and consciousness- A tribute to John G.Taylor. In Neural Networks (IJCNN), *The 2013 International Joint Conference on*. Dallas, TX: USA, pp.1-3.

Kramarski, B., & Gutman, M. (2006). How Can Self-Regulated Learning Be Supported In Mathematical E-Learning Environments? *Journal of Computer Assisted Learning,* 22, 24-33

Kramarski, B., & Zeichner, O. (2001). Using Technology to Enhance Mathematical Reasoning: Effects of Feedback and Self-Regulation Learning. *Educational Media International,* 38(2/3), 77-82.

Ku, K. & Ho, I. (2010). Metacognitive strategies that enhance critical thinking. *Metacognition Learning*. vol.5, pp. 251-267.

Kuo, E., Hull, M., Gupta, A. & Elby, A. (2013). How students blend conceptual and formal mathematical reasoning in solving physics problems. *Science Education,* vol.97(1), pp.32-57.

Lai, E.R. (2011). *Metacognition: a literature review* [online]. UK: Pearson. [Accessed 29 September 2012]. Available at: http://www.pearsonassessments.com/hai/images/tmrs/Metacognition_Literature_Review_Final.pdf

Mevarech, Z. & Fridkin, S. (2006). The effects of IMPROVE on mathematical knowledge, mathematical reasoning and meta-cognition. *Metacognition and learning,* vol.1(1), pp.85-97.

More, T. & Hill, G. (2002). Integrating calculus and general physics using a work-shop and peer leader approach. *Pathways To Change: An International Conference on Transforming Math and Science Education in the K16 Continuum* [online]. STEMTEC at Arlington, Virginia. [Accessed 2 January 2014]. Available at: http://k12s.phast.umass.edu/stemtec/pathways/Proceedings/Papers/More-p.pdf

National Research Council (2013). *National Science Education Standards* . Washington, DC: The National Academies Press.

Ozsoy, G. & Ataman, A. (2009). The effect of metacognitive strategy training on mathematical problem solving achievement. *International Electronic Journal of Elementary Education,* vol.1(2), pp.67-82.

Pajares, F. (2003). Self-efficacy beliefs, motivation, and achievement in writing: A review of the literature. *Reading and Writing Quarterly*, vol.19(2), pp.139-158.

Parsons, M. (2011). *Effects of Writing to Learn in Pre-Calculus Mathematics on Achievement and Affective Outcomes for students in a Community College Setting: A Mixed Methods Approach.* Ph.D. Thesis. Colorado State University. Fort Collins, Colorado.

Sandi-Urena, S., Cooper, M. & Stevens, R. (2011). Enhancement of Metacognition Use and Awareness by Means of a Collaborative Intervention, *International Journal of Science Education*, vol.33(3), pp.323- 340.

Schraw, G. (1998). Promoting general metacognitive awareness. *Instructional Science, 26*(1-2)., 113-125.

Schraw, G. & Dennison, R.S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology, 19*(4), 460-475.

Schraw, G., Crippen, K.J., & Hartley, K. (2006). Promoting self-regulation in science education: Metacognition as part of a broader perspective on learning. *Research in Science Education, 36*(1-2), 111-139.

Thomas, G.P., Anderson, D., & Nashon, S. (2007). Development of An Instrument Designed to Investigate Elements of Science Students' Metacognition, Self-Efficacy and Learning Processes: The SEMLI-S. *International Journal of Science Education.*

Veenman, M. (2012). _Metacognition in science education: definitions, constituents, and their intricate relation with cognition'. In A. Zohar, and Dori, Y. (eds). *Metacognition in Science Education: Trends in Current Research.* Berkeley, CA: Springer, Ch.2.

Veenman, M.V.J., Hout-Wolters, B.H.A.M., & Afflerbach, P. (2006). Metacognition and Learning: Conceptual and Methodological Considerations. *Metacognition and Learning, 1,* 3-14.

Watkins, K. (2001). Learning by changing: Action science and virtual organization development. *Adult Learning*, vol.11(3), pp.20-22.

Wiezbicki-Stevens, K. (2009). *Metacognition: Developing Self-Knowledge Through Guided Reflection.* Ed.D. Thesis. University of Massachusetts-Amherst.

Zimmerman, B. (2008). Investigating Self-Regulation and Motivation: Historical Background, Methodological Developments, and Future Prospects. *American Educational Research Journal, 45,* 166-183.

Zimmerman, B. & Cleary, T. (2006). Adolescents' development of personal agency: The role of self-efficacy beliefs and self-regulatory skill. In F. Pajares and T. Urdan (eds). *Self-efficacy beliefs of adolescents.* Greenwich, CT: Information Age Publishing, pp. 45-70.

Zimmerman, B. & Martinez-Pons, M. (1990). Students' Differences in Self-Regulated Learning: Relating Grade, Sex, and Giftedness to Self-Efficacy and Strategy Use. *Journal of Educational Psychology*, vol.82(1), pp.51-59.

Zohar, A. & Barzilai, S. (2013). A review of research on metacognition in science education: current and future directions. *Studies in Science Education*. vol.49(2), pp.121-169.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 143-150

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

The Effect of Using SMART Board to the 7th Grade Students' Achievement and Recognition Level in Human and Environment Unit

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Abstract: In this study, the effect of SMART Board usage in the 7th grade Human and Environmental unit was investigated on the academic achievement of the students and their recall levels. For research; two middle schools were used in Konya province Hadim District. One of the schools was chosen as the control group and the other was chosen as the experimental group. The Unit Achievement Test was used as data collection tools. For 4 weeks, the students in the control group processed the Human and Environmental unit according to the traditional methods while the students in the experimental group were processed using the same unit smart board activities. The obtained data were analyzed with SPSS 22 statistical package program and t-test was used in the evaluation of the obtained data. In this study comprised of quantitative data on the results of the analysis of the data obtained in academic achievement between the experimental group and the control group, the experimental group in favor of the students it was identified as statistically significant difference. Furthermore, according to the results of the application recall test, the recall rate of the students in the experimental group is higher than the students in the control group. In the data obtained in this study; to the 7th grade students of the junior high school, the use of SMART Board in the teaching of the Human and Environmental unit has achieved academic success and easier to remember learned information.

Keywords: Human and environment, Smart board, Level of recall, Science teaching

Introduction

Today, societies need individuals who have lifelong learning skills, in other words they can continuously renew their knowledge, adapt to change, follow developments, become informed conscious consumers, and produce information. What is expected from educational institutions that are responsible for educating individuals in accordance with the human motives needed by society is to educate individuals who are equipped with knowledge skills (who can access, use, transmit and produce information), who can use technology and learn to learn to oneself (who has learned to learn) (Akkoyunlu and Kurbanoğlu, 2003).

It can be said that the developments of the countries we are in can be measured by education level and knowledge, not by material situation. Because the knowledge gained by education to individuals is expected to turn into economic gain and progress in a very short time (Danaoğlu, 2009). Human beings are entering the race to develop technologies and use the technologies they have developed since the moment they came into the world. Countries that follow technology closely and are open to technological developments have a more advantageous position than other countries. As a result, many countries try to integrate the technologies they develop into education, which is the architect of the future. During this integration, some technologies were found to be efficient and others were not (Wood and Ashfield, 2008).

There is a direct relationship between progress in the field of Science and the development of a country. Therefore, science education is of great importance for the country's future. It is thought that success will be improved with education and training that takes the student to the center. One of the best ways to improve success is to plan educational systems that will bring the student to the centre of the process (İnal, 2014).

One of the efficient ways to achieve the gains in science course is to give the necessary importance to experiments and projects in the courses (Karaduman, 2008). As some of the experiments at secondary school level can be done in a laboratory environment, students do not know laboratory rules and tools to use and teachers do not allow students to perform the experiment during the experiment, students do not fully establish the connections between concepts and the realization of the order of the results is low (Başdaş, Kirişçioğlu and Oluk, 2006). It is thought that computer-aided education is an efficient and impressive way for students to create links between the subjects and concepts they have difficulty understanding (Çömek, 2003). One of the most foremost of these educational technologies is the so-called interactive whiteboard, smart board or electronic board, which has increased its use in recent years (Becta, 2004; Kennewell, 2006).

SMART Board helps students discover new information by enabling interactive activities, and it increases students ' attention, interest and motivation to lesson and topic, as it allows students to create different activities according to their age, learning styles and other characteristics (Kennewel, 2006; Shenton and Pagett, 2007). Using SMART Board makes it easier for students to learn abstract concepts; by recording all the activities during the lesson, it enables them to be reused in the future, to share these activities with others and thus to allow the teacher to easily access the work of the teacher at any time (Adıgüzel, Gürbulak and Sarıçayır, 2011). In addition, the use of SMART Board allows teachers to move the course more smoothly by giving them the chance to intervene quickly and in time during the course and allows teachers to easily and diversify measurement and evaluation activities at the beginning, within, and at the end of the course (Adıgüzel et al., 2011).

Wall, Higgins, Smith and Miller (2005) evaluated the potential impact of smart boards in their assessment of the literature is positive and very strongly about, but asserts that as their priority are based on teacher and student feedback. When we look at the studies in this field in Turkey (Öztan, 2012), the use of SMART Board has shown the effect of the students ' academic achievements. In addition, (Özenç and Özmen, 2014) showed the effect of SMART Board use on students ' success and attitudes in their study.

SMART Board is a useful presentation tool that teachers can access at one touch of resources that can be used to replace traditional and modern classroom resources (such as blackboard, whiteboard, overhead, maps, pictures, number validations, books, calculators and cassette and video players), which will take years to accumulate and will have a huge wardrobe to store them (Becta, 2006).

SMART Board should be used with all potential if it is desired to be effective in teaching and learning. The teacher must adapt this tool to the approach he uses, and learn how to use the possibilities offered by the SMART Board in the learning interaction. New tools provide the opportunity to create new types of activities, but these new types are created by users as users develop skills to use new tools, not by themselves (Lewin, Somekh and Steadman, 2008).

Research Problem

What is the impact of SMART Board applications on students ' achievement and recall levels in science lesson?

Sub-Problems

Answer to the following sub-problems related to the problem sentence of the research:

1. Do the success scores of the experimental and control groups in the human and environment unit differ in the pre-test?
2. Does the success scores of the control group in the human and environment unit differ in the pre-test and post-test?
3. Does the success scores of the experimental group in the human and environment unit differ in the pre-test and post-test?
4. Do the success scores of the experimental and control groups in the human and environment unit differ in the post-test?
5. Do the success scores of the experimental and control groups in the human and environmental unit differ in the recall test?

Hypotheses

The hypotheses used in this research are expressed for the answer of the research problem and its sub-problems.

1. There is no significant correlation between the pre-test scores of the experimental and control groups in the human and environment unit.
2. There is a significant correlation between pre-test and post-test scores in the control group in human and environmental units.
3. There is a significant correlation between the pre-test and post-test scores of the experimental group in the human and environment unit.
4. There is a significant correlation between the post-test scores of the experimental and control groups in the human and environment unit.
5. There is a significant correlation between the recall test scores of the experimental and control groups in the human and environment unit.

Method

In this study, the effect of SMART Board use on students ' success and recall levels in human and environmental units was investigated. Quasi-experimental design was used in the study. The research consists of 42 students studying in the seventh grade of two secondary schools affiliated to MEB in Hadim District of Konya Province.

Table 1. Number of students in groups

Group	Male	Female	N
Experimental	12	9	21
Control	10	11	21
Total	22	20	42

In the research, The Unit Achievement Test developed by Yücel (2013) was used. The average item discrimination factor (rjx) is approximately 0.49; the average item difficulty (Pj) is approximately 0.59, KR 20 reliability coefficient is 0.82.

“Human and Environment” unit topics were lectured in both groups for 4 weeks. The subjects were explained to both groups by the researcher. In this way, individual differences in teaching skills of the teacher were eliminated and the teaching was made more effective. The subjects were explained to the experimental group using SMART Board. The control group was told by using the experiments and activities in the textbook according to the Science Curriculum.

The Unit Achievement Test was applied to the experiment and control group as both pre-test and post-test. For the analysis of The Unit Achievement Test consisting of 27 questions, the correct number of students was determined. Then, each correct answer is evaluated as 3.7 points and each student's score is calculated. The lowest score is 0 and the highest score is 100. In addition to the evaluation of the total scores of students, the correct answer numbers on the subjects of ecosystem, biodiversity and environmental problems which constitute the contents of The Unit Achievement Test were also evaluated. Data obtained from the study were analyzed by SPSS 22 statistical program. The level of significance was determined as 0.05.

Before starting the study, “independent t-test” was used to compare two independent groups, whether there was a significant correlation between the experimental group and control group’s test results of the unit achievement test applied to both group. The Control and Experimental Group's Unit Achievement Test was determined by applying the "dependent t-test" used to compare two measurements from a single group to determine whether there is a significant relationship between pre-test and post-test results. The "independent t-test" was used to compare two independent groups to determine whether there was a significant correlation between the post-test results applied to the experimental and control groups.

Findings

Hypothesis 1: There is no significant correlation between the pre-test scores of the experimental and control groups in the human and environment unit.

After the analysis of the pre-test results applied to the control and experimental groups, pre-test scores, standard deviations (SD), degree of freedom (df) and p values were given in Table 2. In the multiple-choice unit achievement test of 27 questions applied as a pre-test, the average score of each group is close to each other ($\bar{X}_{control}$=22, 72; $\bar{X}_{experimental}$=25, 19).

Table 2. Unit achievement test control and experimental groups pre-test data

Group	N	$\bar{X}$	SD	df	t	p
Experimental group pre-test	21	25,19	8,64	40	1,01	,314
Control group pre-test	21	22,72	6,95			

There was no significant difference between groups (t=1.01, p=.314; p>0.05). This result shows that pre-application human and environmental units are close to each other between SMART Board usage and the experimental group and the control group where the same subject is handled with the Science Curriculum. As a result, it is observed that academic achievements in both groups are close to each other and their knowledge and experience are similar. According to this, the scores of both groups ($\bar{X}_{control}$=22, 72; $\bar{X}_{experimental}$=25, 19) are close to each other and it can be said that the aim of the study is appropriate because there is no significant difference between them. Hypothesis 1 accepted.

Hypothesis 2: There is a significant correlation between pre-test and post-test scores in the control group in human and environmental units.

After the analysis of pre-test and post-test scores applied to the control group, the mean scores, standard deviations (SD), degree of freedom (df) and p value were given in Table 3. The mean of pre-test scores of the control group students was $\bar{X}_{control}$=25, 19; the post-test scores were $\bar{X}_{control}$=39, 81.

Table 3: Unit Achievement Test Control Group Pre-test and Post-test Data

Group	N	$\bar{X}$	SD	df	t	p
Control group pre-test	21	25,19	8,64	20	4,80	,000
Control group post-test	21	39,81	17,11			

There was a significant difference between the control group pre-test and the post-test (t=4, 80, p=, 000; p<, 05). According to these results, there is a significant difference in the control group after the application compared to the application before the application. As a result, we can say that learning takes place in any environment. It can be said that the implementation of the Science Curriculum in the teaching of the "Human and Environment" unit has a positive impact on academic success. Hypothesis 2 accepted.

Hypothesis 3: There is a significant correlation between the pre-test and post-test scores of the experimental group in the human and environment unit.

After the analysis of pre-test and post-test scores applied to the control group, the mean scores, standard deviations (SD), degree of freedom (df) and p value values were given in Table 4. Students in the experimental group pre-test average score on the $\bar{X}_{experimental}$=25, 19; post-test average score on the $\bar{X}_{experimental}$=56, 25 as were found.

Table 4. Unit achievement test experimental group pre-test and post-test data

Group	N	$\bar{X}$	SD	df	t	p
Experimental group pre-test	21	25,19	6,95	20	7,25	,000
Experimental group post-test	21	56,25	17,11			

Unit achievement test in the experimental group pre-test and post-test dependent groups t-test" according to the results there was a significant difference (t=7.25, p=, 000; p<, 05). According to these results, there is a significant difference in the experimental group after the application compared to the application. Based on this result, it can be said that the use of SMART Board in the teaching of the "Human and Environment" unit increases the academic success of the students in the experimental group. Hypothesis 3 accepted.

Hypothesis 4: There is a significant correlation between the post-test scores of the experimental and control groups in the human and environment unit.

Unit Achievement Test are applied to the experimental and control groups post-test scores of "independent groups t-test after analysis, the mean score, standard deviations (SD), degree of freedom (df), and p value are given in Table 5.

Table 5. Unit achievement test control and experimental groups post-test data

Group	N	$\bar{X}$	SD	df	t	p
Control group post-test	21	39,81	17,11	40	3,23	,002
Experimental group post-test	21	56,25	15,76			

The Unit Achievement Test, which was applied as a pre-test before the students learned the subject, was applied as a post-test to both the control group and the experimental group after the application. Students in the control group post-test average score of $\bar{X}_{control}$ =39, 81; students in the experimental group post-test average score on the $\bar{X}_{experimental}$ =56,25as were found. There was a statistically significant difference between the scores of the two groups (t=3.23, p=0.012; p<0.05).

After the application, the lowest score of the test group students obtained from the unit success test was 33.2 out of 100 and the control group students were 14.8 out of 100. The highest score was 96.2 in the experimental group and 74 in the control group. The majority of test group students (90.3%), 41 and above, while the number of students in the control group (42.7%) remained around (Table 6).

Table 6. Unit achievement test control and experimental groups post-test score distributions

Control Group (N=21)					Experimental Group (N=21)				
X min	X max.	Points Ranges	N	Percent	X min	X max.	Points Ranges	N	Percent
14,8	74	0–20	2	9,5	33,3	96,2	0–20	0	0
		21–40	10	47,6			21–40	2	9,5
		41–60	6	28,5			41–60	14	66,6
		61–80	3	14,2			61–80	3	14,2
		81–100	0	0			81–100	2	9,5

Approximately 39% of students in the control group answered these questions correctly, while 56% of the students in the experimental group answered correctly the questions in the Unit Achievement Test post-test. Questions about the ecosystem in the experimental group of students, approximately 64%, of the students in the control group, approximately 41%; questions about the biological diversity of the students in the experimental group, approximately 53%, control group students approximately 36% in the experimental group and the environmental issues questions about students with approximately 50% of control group students and nearly

40% gave the correct answer. Accordingly, it is seen that the students in the experimental group showed better results in the Unit Achievement Test.

Hypothesis 5: There is a significant correlation between the recall test scores of the experimental and control groups in the human and environment unit.

After the analysis of "independent groups t-test", the mean scores, standard deviations (SD), degree of freedom (df) and the p value were given in Table 7.

Table 7. Unit achievement test control and experimental groups recall test data

Group	N	$\bar{X}$	SD	df	t	p
Control group recall test	21	37,35	16,41	40	3,43	,001
Experimental group recall test	21	54,09	15,09			

The mean of the recall test scores of the students in the control group is $\bar{X}_{\text{recall test}} = 37, 35$; the average of the recall test scores of the students in the experimental group was found to be $\bar{X}_{\text{recall test}} = 54, 09$. There is a statistically significant difference between the two groups' average scores ($t = 3, 43$, $p =, 001$; $p <, 05$). It is understood from this that learning the information in the experimental group using SMART Board has become more permanent compared to the science and Technology teaching program applied to the control group. According to this data, hypothesis 5 was accepted.

The mean of pre-test, post-test and recall tests of both groups are shown in Table 8 and Figure 1.

Table 8: Pre-test, post-test and recall test data of experimental and control groups

Group	Pre-test	Post-test	Recall Test
Control Group	22,72	39,81	37,35
Experimental Group	25,19	56,25	54,09

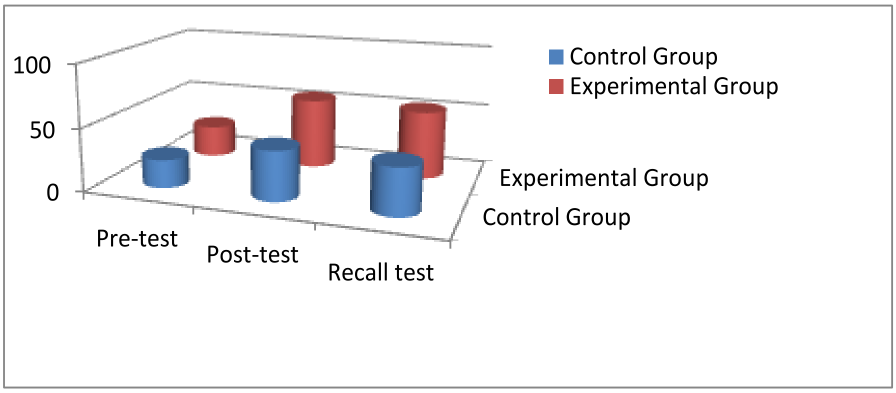

Figure 1. Pre-test, post-test and recall test data of experimental and control groups

Table 8 and Figure 1 shows that learning takes place in every environment, but the average scores in both the final-test and the recall test are much higher than the control group. This clearly demonstrates the purpose of our research. Because SMART Board applications were applied to the experimental group. These activities have increased students ' academic achievement in the "human and environment" unit and have made it easier to remember and remain informed.

Conclusion and Discussion

The unit achievement test was applied to measure students ' academic achievement. The courses were carried out by the researcher in both groups. Before starting the study, a pre-test was applied to measure the pre-test results of both groups, and after the end of the application, the same test was applied as a final test and 3 weeks after the test was applied as a recall test.

In order to determine the cognitive development of the students, firstly the difference between the pre-test scores and the post-test scores of the students of the control group and the pre-test scores and the post-test scores of the students of the experimental group were evaluated. As expected from every student within a specific teaching process, there was a significant difference between the pre-test and post-test scores of the students in the control group, both using SMART Board and the experimental group, as well as in the current program, and the cognitive development of the students.

In the analysis performed, it was determined that both experimental and control group students had an increase in unit success scores, but the increase in the scores in the experimental group students was higher. It was determined that the scores of the students in the experimental group were significantly higher when The Unit Achievement Test post-test scores of the students in the experimental and control groups were compared. This situation is also evident in the scores distribution of the students of the experimental and control group. The highest score in the experimental group was 96.2 out of 100 and 81.4 out of the control group. While the students in the experimental group score between 61-80 (14.2%) and 81-100 (9.5%), the majority of the students in the control group score between 21-40 (47.6%) and 41-60 (28.5%). These results show that supporting teaching with SMART Board activities increases students ' academic achievement.

When the recall test results were examined, it was found that the information learned in both groups was not forgotten. However, the fact that the scores were higher in the experimental group compared to the control group shows that SMART Board use contributes to learning in science lesson and makes it easier to remember information.

According to the results obtained from the research, SMART Board in science teaching has a positive impact on students ' academic achievement. This is consistent with the literature data. Aktaş (2015) found the academic success of the teaching supported by SMART Board and the permanency of the information in the science lesson of the students. In addition, in the studies conducted in the country Önder (2015), Dikmen (2015), Türkoğlu (2014), Tercan (2012) and Öztan (2012), SMART Board has determined the positive impact of academic success.

Another of the objectives of this research is that the use of SMART Board has an effect on students' recall level of knowledge. When the results were examined at the end of the study, the level of recalling the students in the experimental group was higher than the other group. As a result, the use of SMART Board in the lecture of the lessons makes the learned information more permanent and easy to remember.

Notes

This study was produced from the master's thesis prepared by the first author under the guidance of the second author.

References

Adigüzel, T., Gürbulak, N., & Sariçayir, H. (2011). Akıllı Tahtalar Ve Öğretim Uygulamaları/Smart Boards And Their Instructional Uses. Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 8(15).

Akkoyunlu, B., & Kurbanoğlu, S. (2003). Öğretmen adaylarının bilgi okuryazarlığı ve bilgisayar öz-yeterlik algıları üzerine bir çalışma. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 24(24).

Aktaş, S. (2015). The effect of Smart Board on students ' academic achievement and retention of information in Science and Technology course. Master's Thesis, Kastamonu University, Institute of Science and Technology, Kastamonu.

Başdaş, E., Kirişçioğlu, S., & Oluk, S. (2006). Fen öğretiminde, yapılandırmacı kuram bağlamında hands-on yöntemi: Önemi, örnek uygulamalar ve değerlendirme. Yapılandırmacılık ve Eğitime Yansımaları Sempozyumu, 29.

Becta (2004). What the Research Says About Interactive Whiteboards. Coventry: Becta.

Becta (2006). Teaching Interactively with Electronic Whiteboards in the Primary Phase.

Çömek, A. (2003), "The effect of the" heat and heat travel "unit in teaching science with computer aided teaching materials to student success", Unpublished Master Thesis, Marmara University Institute of Educational Sciences, Istanbul.

Danaoğlu, G. (2009). The Relationship between Class and Branch Teachers in the 5th Grade of Elementary School and the Undesirable Behaviors and Coping Strategies. Unpublished Master's Thesis, Cukurova University, Institute of Social Sciences, Adana.

Dikmen, S. (2015). The Impact of Intelligent Teams on the Course Success. Master Thesis, Fırat University, Institute of Science and Technology, Elazığ.

İnal, Z. (2014). Secondary School 6th Grade Science and Technology Lesson The Effect of Model Usage on the Success and Retention of Material and Heat Unit Education. Master Thesis. Kastamonu University, Institute of Science, Kastamonu.

Karaduman, B. (2008). The effect of computer assisted and computer based teaching methods on academic achievement and permanence in the teaching of elementary school science and technology course "granular structure of matter", Master Thesis, Cukurova University Institute of Social Sciences, Adana.

Kennewell, S. (2006). "Reflections on the Interactive Whiteboard Phenomenon: A Synthesis of Research From the UK". AARE (Australian Association for Research in Education) Conference, 26-30 Kasım, Adelaide, Australia.

Lewin, C., Somekh, B. and Steadman, S. (2008). Embedding interactive whiteboards in teaching and learning: The process of change in pedagogic practice. Education and Information Technologies, 13, 291-303.

Önder, R. (2015). The Effect of the Use of Smart Board in Biology Course to the Academic Achievement, Smart Board Usage and Attitudes Towards the Course of the Students. Master Thesis, Dokuz Eylül University, Institute of Educational Sciences, İzmir.

Özenç, E. G., & Özmen, Z. K. (2014). Akilli Tahtayla İşlenen Fen ve Teknoloji Dersinin Öğrencilerin Başarisina ve Derse Karşi Tutumlarina Etkisi. Türkiye Sosyal Araştırmalar Dergisi, 182(182), 137-152.

Öztan, A.C. (2012). The Use of Intelligent Boarding in the Teaching of Science and Technology to the Academic Achievement of the 7th Grade Primary School Students. Master Thesis, Necmettin Erbakan University, Institute of Educational Sciences, Konya.

Shenton, A. ve Pagett, L. (2007). "The Use of The Interactive Whiteboard for Literacy in Six Primary Classrooms in England". Literacy, 41, 129-136.

Tercan, İ. (2012). The Effect of Using Smart Board on the Success, Attitude and Motivation of Science and Technology Lessons of Students. Graduate Thesis, Necmettin Erbakan University, Institute of Educational Sciences, Konya.

Türkoğlu , T. (2014). The Effects of Using Intelligent Boarding in Science and Technology Teaching on Academic Achievement, Attitudes and Opinions of Grade 6 Students. Graduate Thesis, Celal Bayar University, Institute of Science, Manisa.

Wall, H., Higgins, S., Smith, H., and Miller, J. (2005). Interactive Whiteboards: Boon or Bangwagon? A Critical Review of the Literature.

Wood, R. and Ashfield, J. (2008). The use of the interactive whiteboard for creative teaching and learning in literacy and mathematics: a case study. British Journal of Educational Technology. 39 (1), 84-96.

Yücel, E. Ö. (2013). Instructional Design and Implementation of Ecosystem, Biological Diversity and Environmental Problems in Science Program, Doctorate Thesis, Uludağ University, Institute of Educational Sciences, Bursa.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 151 - 156

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

The Effects of using Algodoo in Science Teaching at Middle School

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Abstract: The study examined the effects of instructional approaches as support for scientific learning using a simulation program, Algodoo. The well-known difficulties on learning science concept is supported by Algodoo program. Algodoo is a physic simulation program and it is integrated 7 th grade work and energy unit science classes. The study is conducted at a state school in İstanbul 2017-2018 semesters ,3 instructors and their two classes totally six classes and 202 students participate the study. The study designed as an experimental research. Each instructors' experiment and control group is randomly selected. During the three weeks, each instructors lecture control group with traditional method and experimental group is studied science lessons supported with Algodoo. Pre-test and post –test are applied to all participant as quantative data tools and reflections and worksheets are applied to experiment groups as qualitative data tools. The acquired results show that students have positive attitudes towards Algodoo program they seen lesson which is applied Algodoo more enjoyable and meaningful for them. These kinds of feedback also effect the students' perspective towards science lesson and students 'success. Algodoo can be applied to students from different education levels.

Keywords: Algodoo, Work and energy unit, Simulations

Introduction

Nowadays called as technology era and it comes together many opportunities together. The needs of the society changes and to meet needs of the society the basic aim of the education is bringing up individuals who are qualified. To generate productive people who are enthusiastic to search and ask it is good idea to use advantages of technology. (Teke, Doğan, & Duran, 2015). Growing as a productive people is the main vision of the Turkey's curriculum. (MEB, 2013) The attempt and projects are supported by Ministry of Education to bring forth scientific literate people who can utilize science knowledge and skills to create problem solving and making reasoned decision in real life situation. (R.Soobard & M.Rannikmae, 2015)

In recent years, the development in every discipline has affected education that it causes changing in education system and curriculum. Many attempt and project is conducted by researchers and ministry to meet the need of society and time. FATİH project is one of these attempts. FATİH project is one of the comprehensive project wants to integrate technology to education. (MEB, Fatih Projesi, 2017). Within the scope of this project interactive white boards(IWB) set in the classes and begin the use. Nearly 80% of the school has IWB in Turkey. It is high percentage when it compares the countries. Around 70% of all classroom in Denmark and Netherlands, and more than 50% of classroom in Australia and USA. (Gregorcic, Etkina, & Planinsic, 2017)

Science education has basic elements and concepts are one of them. Concepts can be defined as ideas, objects or events that helps people see the world around. Conceptual understanding permits one to transfer an explanation of a phenomenon to different variants of a situation that have been previously analyzed, is clearly a goal to be recruited under the label learning the science at any level. (Viennot) At some points it's aims is parallel to scientific literacy.

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

Energy is an important and interdisciplinary concept in science education. It is related to daily life and exists in various forms like; heat, electricity, kinetic energy, light, sound. Despite of familiarity, students have problems with energy concepts. Teachers and students states many reasons why they face with problem with this topic, the emphasis on it is and abstract and complex concept. The teaching procedure of energy concept should be supported by different materials and teaching approaches. Technology is chance to manage this problem. (Bezen, Bayrak, & Aykutlu, 2016)

Energy underpins many topics in science education such as work, power, force, photosynthesis, chemical reactions. It is core subject for science education but it is an abstract concept and both teachers and students have difficulty on setting connection with other topic to energy, transition to real life. (Hırça, Çalık, & Seven, 2011).

The needs of the society and the developments in the society brings with the new requirements during the educational process. The productive combination of needs and technological advantages is suitable way to prepare educational materials that meet the needs of each students. Technology is not an alternative of teachers but it is an advantage comes with time. The effective use of technology in educational process increases the quality of educational materials and educations. Animations, simulations, graphics, audio visual materials are the product of technology which serve to make real educational objectives to students' individual differences and learning styles. (Güven & Sülün, 2012)

Simulations are educational programs that are easy to use and free of expense, so they became the most frequently preferred educational tools which are the product of technology. Simulations both give chance to students to create own virtual world and experience what they want to try. The opportunity to create a discussion with data can be easily design by using simulations. (Silva, 2014)

The examined literature shows that there are applied research about Algodoo and they mostly related with high school students, physic classes and pre service teacher. There is not a research Algodoo with secondary school. The related topic and research question is decided with respect to this gap in the literature and students' need. The topic is selected from 7th grade science curriculum work and power unit.

Method

Participant

Table 1. Number of participant

Class	# of Boys	# of Girls
7/A (A1)	18	15
7/B (C1)	17	17
7/E (C2)	22	12
7/F (A2)	18	17
7/İ (A3)	17	16
7/L (C3)	20	13
TOTAL	112	90

Table 2. Research design

GROUPS	PRETEST	APPLICATION	POSTTEST
CONTROL GROUPS	*TAT*	Traditional Science Education	*TAT*
EXPERIMENT GROUP	*TAT*	Science Education which is Supported by Algodoo Using	*TAT*

Research Design

The study is conducted in a state school in Istanbul. Experimental research design is used in this research. Experimental research design is selected as appropriate research type because it is the best type for testing hypotheses about cause and effects. (Fraenkel & Wallen, 2005). The independent the changes of students are examined with respect to technology attitude test after application of Algodoo in science classes.

Results and Discussion

Results

Table 3. Means and standard deviations of the TAT pre-test and post-test scores

		Pre-test		Post-test	
Class	N	Mean	Standart Deviation	Mean	Standart Deviation
Algodoo1(A1)	33	3,95	0,57	4,24	0,54
Algodoo2(A2)	35	4,18	0,56	4,30	0,44
Algodoo3(A3)	33	4,01	0,55	4,25	0,49
Control1(C1)	34	4,17	0,52	4,41	0,43
Control2(C2)	34	3,91	0,62	4,03	0,69
Control3(C3)	33	4,26	0,58	4,29	0,51

TAT(Technology Attitude Test)

Table 3 shows that the TAT's mean and standard deviation of the control and application groups' pre and posttests. The lowest mean score of pretest is observed C2 group and the highest mean score is observed C3 group. The lowest mean score of posttest is observed C2 and the highest score is observed C1 group. The incensement is in the scores of the Algodoo groups after the intervention. ($Algodoo1_{pre}$ =3,95 $Algodoo1_{post}$ =4,24; $Algodoo2_{pre}$ =4,18 $Algodoo2_{post}$ =4,30; $Algodoo3_{pre}$ =4,01 $Algodoo3_{post}$ =4,25)

Table 4. ANCOVA test results for the effects of Algodoo-based instruction on the TAT

Dependent Variable: Posttest						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	17,927[a]	6	2,988	14,619	,006	,310
Intercept	19,375	1	19,375	94,798	,000	,327
Pretest	15,213	1	15,213	74,438	,000	,276
Class	1,345	5	,269	1,316	,259	,033
Error	39,854	195	,204			
Total	3720,302	202				
Corrected Total	57,781	201				

a. R Squared = ,310 (Adjusted R Squared = ,289)

Discussion

The research attempt to examine the effects of using Algodoo in science lessons at middle school. Science education has an important place both education life and daily lives. Science education mostly depend on the understanding and setting relationships between the concepts. In other words, growing scientific literate people the primary aim of science education. (MEB, 2013). Scientific literate people is a need for both society and era. Needs and developments brings with positive and negative features with together so manipulations on each areas are inevitable truths. Education is an ongoing and alive process so integrating new developments into educations especially classes is necessity. Technology integration into classes is one of the attempt to meet the needs of society. The attempt is mostly supported by state and FATİH project is an evidence of this. FATİH project is one of the comprehensive project wants to integrate technology to education. (MEB, 2017). Within the scope of this project interactive white boards(IWB) set in the classes and begin the use. Nearly 80% of the school has IWB in Turkey.

The examined literature shows that using simulations and Algodoo has positive effects on students' science achievement. Energy is an abstract concept and students have problems with this topic. Misconceptions and energy conversion are the mostly problematic part of the topic. To get rid of misconceptions students must be dissatisfied with their existed conceptions; and the new concepts must be intelligible and plausible. At this point serving different information sources to learners is a reasonable way. Technology is a good way to supply different teaching material and sources (Lee, 2014). The study is conducted by Akbulut, Şahin and Çepni(2013) shows that the main reason of misconceptions which are related to energy topic is that students are passive so they do not embodied the topic. To solve this, students should be active during the knowledge acquisition process. (Akbulut, Şahin, & Çepni, 2013) Simulations create chances to students being active in the process and embodied the topic.

Technology usage in classes is a contradictive topic but to meet the needs of society and era the integration of technology into education should be done effectively. Simulations are the applications which are comes with the technology. Algodoo is a simulation application easy to use in the classroom. The study examines the effect of using Algodoo in science classes on technology attitudes.

Students' feedback of Algodoo using in the science classes is positive. They declare that it is enjoyable, playful, observable. The statements show that students are more eager to participate to lessons and they are more active. Teachers are the most important part of education process. However, this does not mean to only they are the active in teaching and learning process. Students should be more active to increase the knowledge acquisition. By using technology teachers can create more student active learning environment. Teachers attitudes play an important role the integration of technology into education. (Rutten, Joolingen, & Veen, 2012)

Algodoo has positive effect on students' attitudes towards technology. The experiment group show higher increasement than control group on technology attitude scores. Algodoo has an easy interface to use. Technology literacy is 21stcentury skill and the improvement of attitudes towards technology is demanded.

Cydis (2015) states that technology integration is a basic feature of students' competence in the technology era. The easy and enjoyable applications make easier to integration of technology into education and increase the students' interest towards technology. (Cydis, 2015) A research which is conducted in Finnish and Estonian schools indicate that Technical craft has an impact on motivation for learning technology. (Autio & Soobik, 2017)

Conclusion

The previous researches shows that using simulations does not have negative effect. Also, the examined results explain the positive relationship between the using Algodoo and knowledge acquisition. The study not only results positive impact on achievement but also different areas like scientific process skills, attitudes towards science and technology. There is significance difference between pre-test and post-test score of the control and experiment group. The higher positive improvement is observed at technology attitude scale of experiment group.

Acknowledgements

We would like to thanks to our families and friends for their supporting during the research process.

References

Akbulut, H. İ., Şahin, Ç., & Çepni, S. (2013). Examining Conceptual Change in Work and Energy Topic:Dual Situated Learning Model Sample. *Mehmet Akif Ersoy Üniversitesi Fakültesi Dergisi*, 241-268.

Algoryx. (2017). *Algodoo*. http://www.algodoo.com/ adresinden alındı

Autio, O., & Soobik, M. (2017). Technological Knowledge and Reasoning in Finnish and Estonian Technology Education. *International Journal of Research in Education and Science*, 193-202.

Aydın, G., & Balım, A. G. (2005). An Interdisiplinary Application Based on Constructivist Approach:Teaching of Energy Topics. *Journal of Facullty of Sciences*, 145-166.

Bezen, S., Bayrak, C., & Aykutlu, I. (2016). Physic Teachers' Views on Teaching the concept of Energy. *Eurasian Journal of Educational Research*, 109-124.

Bollen, L., & Joolingen, W. R. (2013). SimSketch:Multiagent Simulations Based on Learner-Created Sketches for Early Science Education. *IEEE Transactıons on Learning Technologies*, s. 208-216.

Cydis, S. (2015). Authentic Instruction and Technology Literacy. *Journal of Learning Design*, 68-78.

Çelik, H., Sarı, U., & Harwanto, U. N. (2015). Evaluating and Developing Physics Teaching Materials with Algodoo in Virtual Environment : Archimedes' Principles. *International Journal of Innovation in Science and Mathematics Education*, s. 40-50.

Daramola, F. O., Yusuf, M. O., & Oyelekan, O. S. (2015). Information and Communication Technology Literacy among Student-Teachers in Universities in Nigeria. *Malaysian Online Journal of Educational Technology*.

Fraenkel, J. R., & Wallen, N. E. (2005). Experimental Research. J. R. Fraenkel, & N. E. Wallen içinde, *How to Design Design and Evaluate Research in Education* (s. 267).

Ghilay, Y., & Ghilay, R. (2015). TBAL:Technology Based Active Learning in Higher Education. *Journal of Education and Learning*, 10-18.

Gregorcic, B., & Bodin, M. (2017). Algodoo:A Tool for Encouraging Creativity in Physic Teaching and Learning. *The Physic Teacher*, 25-28.

Güven, G., & Sülün, Y. (2012). Bilgisayar Destekli Öğretimin 8.Sınıf Fen ve Teknoloji Dersindeki Akademik Başarıya ve Öğrencilerin Derse Karşı Tutumlarına Etkisi. *Türk Fen Eğitimi Dergisi*, 68-79.

Hırça, N., Çalık, M., & Seven, S. (2011). 5E Modeline Göre Geliştirilen Materyallerin Öğrencilerin Kavramsal Değişimine ve Fizik Dersine Karşı Tutumlarına Etkisi:İş,Güç,Enerji Ünitesi Örneği. *Türk Fen Eğitimi Dergisi*, 139-152.

Lee, C. K. (2014). A Conceptual Change Model for TEaching Heat Energy,Heat Transfer and Insulation. *Science Education International*, 414-437.

MEB. (2013). *İlköğretim Kurumları Fen BİlimIeri Dersi Öğretim Programı.*

MEB. (2017). *Fatih Projesi*. http://fatihprojesi.meb.gov.tr/. adresinden alındı

Özer, İ. E., Bilici, S. C., & Karahan, E. (2015). Fen Bilimleri Dersinde Algodoo Kullanımına Yönelik Öğrenci Görüşleri. *Trakya Üniversitesi Eğitim Fakültesi Dergisi*, s. 28-40.

R.Soobard, & M.Rannikmae. (2015). Examining Cirriculum Related Progress Using a Context Based Instrument-A Comparison of Estonian Grade 10 and 11 Students. *Scienve Education International*, 263-283.

Rutten, N., Joolingen, W. R., & Veen, J. T. (2012). The Learning Effects of Computer Simulations in Science Education. *Computers&Education*, 136-153.

Sharma, R. M., Sharma, A., & Sharma, A. (2017). Using ICT-based Instructional Technologies to Teach Science :Perspectives from Teachers in Trinidad and Tobago. *Australian Journal of Teacher Education*, 23-35.

Silva, S. L., Silva, R. L., Junior, J. T., Gonçalves, E., Viana, E. R., & B.L.Wyatt, J. (2014). Animation with Algodoo:A simple tool for teaching and learning physic. *Exatas Online*, s. 28-39.

Teke, H., Doğan, B., & Duran, A. (2015). Influencen of the Simulation Method on 7th Grade Students' Achivements in Science and Technology Lessons. *International Journal of Research in Education and Science*, 111-118.

Viennot, L. (n.d). Learnıng And Conceptual Understandıng:Beyond Sımplıstıc Ideas, What Have We Learned? University Denis Didero.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 157-165

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

The use of Multimedia in Teaching Biology and Its Impact on Students' Learning Outcomes

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Abstract: In this 21st century of Information and Communication Technology, a motivating and captivating approach should be encouraged to help students better learn. The use of multimedia in education has proven its importance due to its positive impact on the teaching and learning process. The study investigated the effectiveness of using Multimedia on students learning outcomes in biology. 180 students were randomly selected from three secondary schools and were randomly divided into three groups. Pretest-posttest control group quasi experimental design was employed for the study. The experimental groups was taught with the help of multimedia presentations whereas the control group was treated traditionally. The treatment was given for a period of 10 weeks. Validated Attitude Towards Biology Scale (ATBS) was tested for reliability using Crombach alpha which stood at 0.76 and Biology Achievement Test (BAT) which was also validated was tested for reliability using Kuder Richardson (KR,20), yielded 0.89, were used as data collection instruments. The data collected were analysed using descriptive and inferential statistics. The results indicated a statistically significant difference between students learning outcomes and modes of instruction. Students under Multimedia Aided Instructions had better outcome than their colleagues in traditional teaching method. Therefore, it is recommended that Multimedia Assisted Instruction should be used in the teaching of biology at secondary school to improve students' learning outcomes in the subject.

Keywords: Multimedia, Biology, Students, Learning outcomes, Secondary school

Introduction

Biology is a science subject which explains the existence of life. It is a natural science which is concerned with the study of living organisms, their structures, forms and functions, heredity, etc. It is a fundamental science subject which serves as the basis for understanding the complexities of how the body parts of organisms function. Biology according to Taiwo & Emeke (2014) the subject exposes the students to the world of knowledge of self, the immediate and distant environment. This may be the bases for its inclusion in the Senior Secondary School (SSS) curriculum in Nigeria. The objectives of teaching Biology in the SSS in Nigeria include adequate laboratory and field skills in biology; meaningful and relevant knowledge in Biology; ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture (FME, 2009).

Despite the importance of the teaching of Biology in SSS in the development of individuals, several studies (WAEC, 2011; Taiwo & Emeke, 2014) report consistent poor performance of students at the internal and external examinations. According to WAEC Chief Examiners' report (WAEC, 2014), there has been a downward trend in students achievement in biology over the years. The results show that for the over one million students per year that registered for Biology, only 35.74%, 35.61%, 33.57%, 33.94% and 33.87% passed at A-C6 level for 2010, 2011, 2012, 2013 and 2014 respectively.

Many factors have been adduced to this poor performance of students in biology achievement. Such factors include teacher quality (Akinsolu, 2010; Anita, 2013), school factors (Mushtaq & Khan, 2016), types of textbooks (MeenuDev, 2016), teaching methodology (Owusu, Monney, Appiah, & Wilmot, 2010), etc. However, the reports have showed that the major cause of poor performance of students to science subjects to be the prevailing method of teaching in science classroom in Nigeria (Ukoh & Adewale, 2014).

In order to achieve the laudable objectives of teaching and learning biology in Senior Secondary School, the teaching of biology should be well strategized to bring about meaningful learning which could improve students' performance. Teaching for understanding and to bring about meaningful learning in Biology may involve the use of appropriate method. Considering UNESCO (2002) recommendation on improving the teaching of science – diversification of contents and methods, promoting experimentation, innovation, the diffusion and sharing of information, this could also be applied in the teaching of biology. The diversification of contents and methods, innovations could be utilized through integration of technology in biology teaching. One important factor that has separated the modern era from those that have gone before it is technology.

Since the current teaching strategies commonly used for teaching science have failed to enhance problem-solving skills, curiosity and critical and logical thinking among the science students (Shan & Khan, 2015), there is a great demand to shift to technology integration strategies as a new form of pedagogy. Most especially paradigm shift of integration of Information and Communication Technology (ICT) since teaching principally involves passage of information through communication.

Information and Communication Technology (ICT) is not something new nowadays. Somehow, ICT appears to be a force which has changed lots of aspects in life. We are all living in the decade of Information and Communication world. ICT is more innovative and could enrich approaches for meaningful learning. The communication technology comprises of all forms of technology to create, store, exchange information (such as business data, video, audio, still images, text, pictures, etc) with high – speed communication links carrying data, sound and video. When more than one of these are utilized in communication process, it is regarded to as Multimedia.

Therefore, multimedia is described as a system of relaying information that involves many different forms of communication. Multimedia might include text, video, audio, still photographs, sound, animation, image and interactive content. It is any combination of the above mentioned that is delivered by computer. Malik & Agarwal (2012) refers to multimedia as the exciting combination of computer hardware and software that allows integration of text resources, audio, animation, graphics, video to develop effective presentation on an affordable desktop computer. Buttressing this view, Neo (2007) says multimedia is characterized by the presence of texts, pictures, sound, animation and video; some or all of which are organized into a coherent program. From the definitions, it could be deduced that multimedia involves communication or presentation of information through multiple channels. Some or all of these elements (i.e sound, animation, text, audio, image, graphic, video, etc) could be combined and used in biology classroom for teaching process.

The multisensory nature of multimedia makes it to stimulate multiple senses of the audience at a time. If applied in biology classroom, it could stimulate students' senses in the classroom and allow interaction between the students and teachers. These could make teaching biology more attractive and interesting to students and as well enhance students' motivation and understanding thereby making learning meaningful and authentic. This is supported by Altherr, Wagner, Ecker & Jold, (2004) and Sousa, Richter & Nel (2017) assertion that multimedia elements have paramount importance in teaching of science since it helps to present different phenomenon and process vividly, simulate complex contents and present different levels of abstraction. Thus, some concepts which appeared abstract to students may become clearer and better retained. This may have positive effects on students' academic achievement and attitude to learning of the subject. However, with the level of technological development and integration in education globally, the use of multimedia in teaching biology in secondary school in Nigeria has not been successive.

When student's interest increases, understanding becomes enhanced and retention ability increased (Gilakjani, 2012), there is tendency for an improvement in academic achievement and attitude. This is in accordance with Mantei (2000) remark that power point presentation in teaching science improves student's attitude towards science.

Attitude is a learned disposition to respond positively or negatively towards a situation, an event or people (Shah and Khan, 2015). It is a disposition to evaluate situations, actions or people in a favourable or unfavourable way. Student's attitude towards a subject is often developed as a result of experiences in different learning environment. Therefore, attitude is very important in student's achievement in a subject. Shah, Iqbal & Rauf, 2010; Soomro, Qaisrani & Uqaih, (2011); Shah & Khan, (2015) in separate reports remark that student's attitude towards learning of science subjects has impact on the academic achievement

The attitude of students towards science subjects may or may not vary with gender. There are mixed reports on existence of differences in male and female students' attitudes towards biology. While some scholars are of the view that student's attitudes toward biology are not affected by gender (Ahmad & Asghar, 2015), others disagree with this submission (Usak, Prokop, Tuncer & Chuda, 2009).

Therefore, this study investigated the impact of the use of multimedia in teaching biology on students' learning outcomes.

Purpose of the Study

The purpose of this study is to investigate whether the use of multimedia to teach could improve secondary school students' learning outcomes (students' achievement and attitude) in biology. Specifically, the study examined the effect of:

i. On screen text, graphics, still images packages and teachers' explanation and those exposed to conventional teaching as posttest.
ii. On screen text, graphic, still images, video packages and teacher' explanation and those exposed to conventional teaching as posttest
iii. Conventional method

Research Questions

The following questions were answered in the study

1. Does any difference exist in the learning outcomes of the groups of students before exposure to treatment?
2. Does any difference exist in the learning outcomes of the groups of students after exposure to treatment?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance.

1. There is no relative effect of treatment on students' learning outcomes
2. There is no relative effect of gender on students' learning outcomes
3. There is no interaction effect of treatment and gender on students' learning outcomes.

Method and Procedure

The study employed a pretest-posttest control group quasi experimental design.

Population

The population for this study is made up of all Senior Secondary School Two (SSS II) biology students in Lagos Mainland Local Government Area, Lagos State, Nigeria.

Sample and Sampling Technique

Senior Secondary School (SSS) in Lagos Mainland with adequate Information and Communication Technology facilities were purposely selected for the study. Out of the four found with ICT materials, three Senior Secondary Schools were randomly selected from Lagos Mainland Local Government Area, Lagos, Nigeria. A sample of sixty students was randomly selected from each of the three schools. In all one hundred and eighty students participated in the study.

Instrumentation

Two instruments were developed and used to collect data for the study:
(a) Biology Achievement Test (BAT)
(b) Biology Students' Attitude Questionnaire (BSAQ).
The BAT was made up of 50 objective questions prepared from past West African Senior Secondary School Certificate Examination questions of West African Examinations Council on the selected topic – Regulation of Internal Environment. The items were developed on the basis of Bloom's taxonomy with the distribution. This was peer reviewed for content and construct validity. The reliability was tested by administration of the test to thirty SSS II students who are not part of the study. The reliability stood at 0.78 using Kuder Richardson 20 (KR 20). The BSAQ was made up of twenty – five questions on SSS II students' attitude. Validation exercise was conducted with the instrument on thirty students who are not part of the study. The reliability coefficient was 0.81 using Cronbach Alpha.

Procedure for the Study

Three schools were randomly selected from Lagos Mainland Local Government Area, Lagos. Nigeria. Sixty Senior Secondary School Two (SS II) students were randomly selected from each of the three schools. Thereafter, the participants were mixed, reshuffled and redistributed into three groups. Each group consisted of sixty participants. The groups were randomly assigned into two experimental and one control. Experimental group one was taught on-screen text, still images and graphic packages and teachers' narration; experimental group two was taught on screen text, still images, graphics, video and teachers' narration while the third group was the control and were taught using lecture method. In order to establish a baseline and ascertain the academic equivalence of the students before the treatments, the Biology Achievement Test was administered to the selected students. This serves as the pretest for the study. Four research assistants were employed and gave necessary orientation and training of the tasks involved in the use of the multimedia in teaching biology and the administration of the instruments. The research assistants were randomly assigned into groups and trained based on the group they were to handle. Three of the research assistants who taught the three groups were graduates in biology education. While the fourth only assisted in the collection of data.

The on-screen text, still images and graphic packages for experimental group one consisted of concepts of regulation of internal environment; while experimental group two consisted of on-screen text, still images, graphic and video packages with concepts on regulation of internal environment. The two packages were developed by the researcher but validated by specialists in biology education and educational technology.

Two lecturers each from Biology Education and two lecturers from Educational Technology, of the Department of Science and Technology Education, University of Lagos, Nigeria; two biology teachers from Senior Secondary Schools in Lagos; and two subject experts in the Test and Measurement Department, West African Examination Council (WAEC) Nigeria, all validated the content of biology, appropriateness of packages and the achievement test. The two packages were tested on some selected SS II students outside the sampled schools. The comments and observations from valuators and students were used to modify the instruments packages. The biology content for experimental groups were produced on a CD-ROM and installed in the system, while the control group used the same content, but was not exposed to multimedia packages.

The researcher visited the selected schools and sought the cooperation of their staff and students. The treatment was administered for four weeks. The multimedia packages were projected onto the screen via a projector. Students read, listened, and watched on the mode of multimedia approaches to teaching in the two experimental groups. Experimental Group I: On screen text, still images, graphics package and teachers' explanation. Sixty students in this group watched the on screen text, still images and graphics depicting explanation of regulation of internal environment. The students also listened as the teacher explained slide by slide concurrently.

Experimental Group II: On screen text, graphic, still images, video and teacher's explanation. The students in this group, who were also sixty, watched the on screen text, still images, graphics and video which depicted concepts of regulation of internal environment. The teacher also explain concurrently
Control Group: Conventional Teaching Method: The control group was exposed to lecture method.
Immediately after four weeks of treatment, BAT and BSAQ were administered as posttest to measure the students' learning outcomes (academic achievement and attitude) of different groups.

Data collected were analysed based on the formulated hypotheses and research questions. Analysis of Covariance (ANCOVA) and Scheffe's post-hoc analysis was employed.

Results and Findings

The result of the study was presented according to the research questions asked and hypotheses raised.

RQ1: Does any difference exist in the learning outcomes of the groups of students before exposure to treatment?

Table 1. Students' performance at before treatment

Comprehension Levels	Mean	SD	Rank
Conventional	20.13	4.74	2nd
With Video	21.20	6.41	1st
Without Video	19.00	5.51	3rd

Table 1 above reveals the highest mean performance (21.20) of students taught with video, followed by 20.13 average mean performances for the students taught with conventional method, and the least mean performance (19.00) for the students taught without video.

RQ 2: Does any difference exist in the learning outcomes of the groups of students after exposure to treatment?

Table 2. Students' performance after treatment

Comprehension Levels	Mean	SD	Rank
Conventional	20.64	5.14	3rd
With Video	23.38	6.24	1st
Without Video	22.31	5.83	2nd

Table 2 above reveals the highest mean performance (23.38) of students taught with video, followed by 22.31 average mean performances for the students taught without video, and the least mean performance (20.64) for the students taught with conventional method.

Ho1: There is no relative effect of treatment on students' learning outcomes

Table 3. Effect of treatment on students' learning outcomes

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	185.506[a]	3	61.835	1.851	.141
Intercept	2270.268	1	2270.268	67.963	.000
Pretest	1.005	1	1.005	.030	.863
Group	180.773	2	90.386	2.706	.070
Error	4576.381	137	33.404		
Total	74911.000	141			
Corrected Total	4761.887	140			

a. R Squared = .039 (Adjusted R Squared = .018)

The table 3 above revealed an F (2, 140) 2.706 was not significant with a value of .07 at 0.05 alpha level. On this basis, the null hypothesis one was accepted since the significant value .07 is greater than 0.05 alpha level (.141 > 0.05). Thus, no significant main effect of treatment on students' learning outcomes existed between the three groups (Experimental I, Experimental II and Control).

Ho2: There is no relative effect of treatment on students' learning outcomes based on gender

Table 4. Effects of treatment on students' learning outcome according to gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	170.476[a]	2	85.238	2.275	.111
Intercept	494.592	1	494.592	13.201	.001
Pretest	93.742	1	93.742	2.502	.119
Gender	158.815	1	158.815	4.239	.044
Error	2322.909	62	37.466		
Total	38038.000	65			
Corrected Total	2493.385	64			

a. R Squared = .068 (Adjusted R Squared = .038)

The table revealed an F (1, 64) 4.24 with a significance value of .04 at 0.05 alpha level. On this basis, the null hypothesis one is rejected since the significant value .04 is less than 0.05 alpha level (.04 < 0.05). Thus, gender had significant effect on students' learning outcomes when exposed to treatment. A follow-up of the posttest mean score test was conducted to locate where the significant difference existed using pairwise comparisons. The mean scores of the two groups are indicated in Table 5.

Table 5. Differences in the effects of treatment on gender

Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Female	21.498[a]	1.190	19.120	23.877
Male	25.214[a]	1.169	22.878	27.550

Table 6. Differences in means of gender based on treatment groups

(I) gender	(J) gender	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Female	Male	-3.716*	1.805	.044	-7.323	-.108
Male	Female	3.716*	1.805	.044	.108	7.323

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

The data in the table indicates that there was a difference in the posttest mean of male and female students exposed to treatment with the highest mean of (25.21) for male and the mean of (21.48) for female. Thus, male performed better than female.

Ho3: There is no interaction effect of treatment and gender on students' learning outcomes

Table 7. Interaction effect of treatment and gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	288.360[a]	5	57.672	1.740	.130
Intercept	1543.506	1	1543.506	46.579	.000
Pretest	26.857	1	26.857	.810	.370
Gender	43.185	1	43.185	1.303	.256
Group	73.511	2	36.756	1.109	.333
gender * group	21.909	1	21.909	.661	.418
Error	4473.527	135	33.137		
Total	74911.000	141			
Corrected Total	4761.887	140			

a. R Squared = .061 (Adjusted R Squared = .026)

Table 7 above revealed an $F_{(1,140)}$ with a significant value of .418 at 0.05 alpha level. On this basis, the null hypothesis is accepted since the significant value is greater than 0.05 alpha level (.418>0.05). Thus, no interaction effect of treatment and gender.

Ho4: There is no relative difference in male and female students' attitude to the use of multimedia in learning biology

Table 8. Differences in male and female students' attitudes to use of multimedia

Gender	No	$\overline{X}$	SD	df	T	Sig
Male	62	24.7	14.82	139	5.38	0.00
Female	79	25.3	9.67			

Table 8 indicates that t (139) = 0.00, p = 5.38 That is, the result of the t- value of 5.38 resulting in 0.00 significance value was lesser than 0.05 alpha level. This means that the stated null hypothesis was rejected.

Discussion

The result of the study revealed an existing difference in the learning outcomes of students before and after exposure to treatment. There was students' improvement in the achievement and attitude to biology. This shows that the use of multimedia in the teaching of biology made the difference. The uses of multimedia in the teaching of biology are accountable for the improved differences in the learning outcomes. The conventional group did not show any improvement in the students' learning outcomes. The multimedia used for teaching in the two treatment groups must have catch students' attention and interest, thereby improving the learning outcomes. This is in support of Aloraini (2012) submission that the uses of multimedia to teach has positive effects on students' learning outcomes while the conventional strategy of teaching does not have an improvement on students' learning outcomes. However, the differences or effect of the multimedia observed on the students' learning outcomes was not significant. This may be due to insufficient skill on the part of the teachers. Many biology teachers have not acquired enough necessary skills needed to use multimedia in teaching biology. This may be due to the fact that the multimedia is not yet part of biology classroom. This implies that the chalkboard and textbook dominate biology classroom activities. This is in accordance with Aduwa-Ogiegbaen & Iyamu (2005) remark that more than 90% of Nigerian public schools still make use of chalkboard and textbook.

The study further revealed that gender has significant effect on students' learning outcomes. The male students have better learning outcomes as compared to the female students. This may be the source of increase or effect of multimedia on students' learning outcomes.

On the combined effect of multimedia and gender, on students' learning outcomes, the result revealed that these have no effect on students learning outcomes. This is in line with Erinoso (2008) and Ebo (2016) submission. But, this finding is contrary to the findings of Arigbabu & Mji, (2004) and Bosede, (2010) that students' academic achievement in science and technology subjects in computer mediated instruction is influenced by gender with male students outperformed the female counterparts.

Conclusion

The adoption and use of multimedia in teaching biology have a positive impact on students' learning outcomes in biology. The lessons presented by multimedia are more effective and better comprehended by students. It is more effective for the cognitive and attitude development of students in biology than the conventional method. Multimedia use in teaching is more attractive and helps students develop positive attitude towards learning biology, thus improving the performance of students.

Recommendation

Based on the findings of this study, it is therefore recommended that multimedia should be used to teach biology in Senior Secondary Schools. To this end, biology teachers need to be trained to acquire necessary skills needed to use multimedia for teaching biology. This is important in preparing teachers for biology teaching, as well as providing in-service training for biology teachers.

References

Adomi, E. E & Kpanghan, E. (2010). Application of ICTs in Nigerian Secondary Schools. Library Philosophy and Practice (e-journal). 345. Retrieved October 5, 2017 from http://digitalcommons.unl.edu/libphilprac/345

Akinsolu, A. O. (2010). Teachers and students" academic performance in Nigerian secondary schools: Implications for Planning. *Florida Journal of Educational Administration and Policy*,3(3),

Aloraini, S. (2012). The impact of using multimedia on students' academic achievement in the College of Education At King Saud University. Journal of King Sand University. *Languages and Translation*, 24 (2)

Altherr, S., Wagner, A., Eckert, B., & Jodi, H. J. (2004). Multimedia materials for teaching physics (search, evaluation and examples). European Journal of Physics. 25.

Anita, J. K. (2013). A study of teacher characteristics and students' academic achievement: Case of Biology subject in selected secondary schools in Nandi South District, Kenya. Indian. *Journal of Research* 2 (3)

Arigbabu A & Mji, A. (2004). Is gender a factor in mathematics performance among Nigeria pre-service teachers? *Sex role*, 51 (11&12).

Bosede, A. F. (2010). Influence of sex and location on relationship between students' problems and academic performance. *The Social Science* 5 (4).

Ebo, R. U. (2017). Effects of computer-mediated multiple intelligence instructional method on students' achievement in Basic Technology in Lagos State. *Proceedings of Association for Innovative Technology Integration in Education.*

Erinoso, Y. E. (2008). Women and Science. *36th Inaugural Lecture*. Olabisi Onabanjo University, Ago- Iwoye.

Federal Ministry of Education (FME) (2009). National Policy on Education. Lagos: NERDC Press.

Gilakjani, A. P. (2012). The significant role of multimedia in motivating EFL learners' interest in English language learning.

I.J.Modern Education and Computer Science, 4. Retrieved July 29, 2017 from http://www.mecs-press.org/ijmecs/ijmecs-v4-n4/IJMECS-V4-N4-8.pdf

Ibe, E., Nworgu, L. N. & Anyaegbunam, N. J. (2016). Influence of teachers' characteristics on academic achievement of Secondary School Biology students. *British Journal of Science. 13 (2)*

IIhan, O. G & Oruc, S. (2016). Effects of the use of multimedia on students' performance: A case study of social studies class. *Educational Research Reviews.* 11(8).

Joshi A. (2012). Multimedia: A technique in teaching process in the classrooms. Curr World Environ 7(1):33-36. Retrieved September 28, 2017 from: http://www.cwejournal.org/?p=1758

Mantei, E. J. (2000). Using Internet class notes and PowerPoint in the physical geology lecture. *Journal of College Science*

Teaching, 29.

Malik, S & Agarwal, A. (2012). Use of media as a new educational tool – A study. International Journal of Information and Education Technology, 2 (5).

MeenuDev, (2016). Factors Affecting the Academic Achievement: A Study of Elementary School students of NCR Delhi, India. *Journal of Education and Practice*. 7 (4)

Mushtaq, I & Khan, S. N (2016). Factors affecting students' academic performance. Global Journal of Management of Business. 12 (9).

Nasr, A. R. (2012). Attitude towards Biology and Its Effects on Student's Achievement *Global Journal of Management and Business Research*. 12 (9)

Neo, M. (2007). Learning with multimedia: Engaging students in constructivist learning. *International Journal of Instructional Media.* 34(2)

Owusu, K. A., Monney, K. A., Appiah, J. Y & Wilmot, E. M. (2010). Effects of computer assisted instruction on performance of senior high school biology students in Ghana. *Journal of Computer and Education*. 55(2)

Prokop, P., Tuncer, G., & Chudá, J. (2007). Slovakian students' attitudes toward biology. *Eurasia Journal of Mathematics, Science & Technology Education,* 3(4),

Shah, I and Khan, M (2015). Impact of multimedia-aided teaching on students' academic achievement and attitude at elementary level. US-China *Education Review*. 5(5).

Shah, Z. A., Iqbal, Z., & Rauf, M. (2010). Effect of problem solving teaching strategy on 8th grade students' attitude towards science. *Journal of Education and Practice, 1*(3). Retrieved August 23, 2017 from http://www.iiste.org/Journals/index.php/ JEP/ article/viewFile/

Soomro, A. Q., Qaisrani, M. N., & Uqaili, M. A. (2011). Measuring students' attitudes towards learning physics: Experimental

research. *Australian Journal of Basic and Applied Sciences, 5*(11), 2282-2288.

Sousa, L.; Richter, B & Nel, C. (2017). The effect of multimedia use on the teaching and learning of Social Sciences at tertiary level: a case study. Yesterday and Today. 17.

Taiwo, S. K & Emeke, E. A. (2014). Relationship among learning style preference, gender, age and students' achievement in senior secondary school biology. *West African Journal of Education,* XXXIV.

Ukoh, E. E & Adewale, J. G. (2014). Science teachers' attitude to ICT integration in science education in Oyo State, Nigeria. *West African Journal of Education,* XXXIV.

UNESCO. (2012). Information and communication technologies in teacher education: A planning guide. Paris. UNESCO.

Usak, M., Prokop, P., Ozden, M., Ozel, M., Bilen, K., & Erdogan, M. (2009). Turkish University students' attitudes Toward biology: The effects of gender and enrolment in biology classes. *Journal of Baltic Science Education,* 8(2).

West African Examination Council (WAEC, 2012). Chief Examiners Report. Lagos.

West African Examination Council (WAEC, 2013). Chief Examiners Report. Lagos.

West African Examination Council, (WAEC, 2011). Chief Examiners Report Lagos.

West African Examination Council, (WAEC, 2014). Chief Examiners Report. Lagos.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 166-174

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

The Effect of Using SMART Board to the 7th Grade Students' Attitudes toward the Environment in Human and Environment Unit

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Abstract: In this study, the effect of SMART Board usage in the 7th grade Human and Environmental unit was investigated on students' attitudes toward the environment. For research; two middle schools were used in Konya Province Hadim District. One of the schools was chosen as the control group and the other was chosen as the experimental group. The Environmental Attitude Scale was used as data collection tools. For 4 weeks, the students in the control group processed the Human and Environmental unit according to the traditional methods while the students in the experimental group were processed using the same unit smart board activities. The Environmental Attitude Scale was applied as a pre-test to determine the students' attitudes toward the environment before the application started. After the application was completed, the same test was applied as a post-test to determine the students' attitudes towards the environment. The obtained data were analyzed with SPSS 22 statistical package program and t-test was used in the evaluation of the obtained data. As a result of the analysis of the post-test data of the Environmental Attitude Scale, although the score of the experimental group was higher than that of the control group, there was no statistically significant difference between the experimental group and the control group. Therefore, it has been found that the use of SMART Board has not been effective in improving students' attitudes towards the environment.

Keywords: Human and environment, Smart board, Environmental attitude, Science teaching

Introduction

In parallel with the information, the development of technology is advancing at a great rate and technological developments in every aspect of life are shown in a very clear way by everyone today. A newly emerging technology is constantly evolving and the new ones are emerging in a very short time. Competition among societies is determined by the level of use of these technologies with the new technologies that are produced today. Industry, agriculture, health, transportation, defense, education, etc. countries that use the most effective technologies in all areas of life, such as those of today, have the power. Therefore, it is very important to follow and use Information and Communication Technologies (ICT) in order to adapt the innovations brought by technology to life and to keep pace with the age.

Technological developments show its impact on all aspects of society. One of the areas where technological developments influence is undoubtedly the education sector. Education is an effective factor in the social, political and economic development of countries. At the same time, education is one of the most effective methods in directing, changing, formatting and developing people. Education and technology is one of the most important factors in determining individuals ' lives, political, social, economic and cultural levels among countries. In particular, the rapid development and change of technology in todays affect education; education naturally affects society (Özkul and Girginer, 2001).

It has been observed that the understanding of the impact of education on individuals and societies ' lifestyles and values, and the effect of rapidly developing technology on education in all nations, has started a movement towards developing a new educational system by integrating education with technology (Kaya, 2002, p.6).

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

Within the framework of this vision, education, which is open to development and innovation, can produce new information, combined with advances in IT technologies, has started to design a rich educational environment. In this respect, the use of IT technologies, which is an element that we can no longer give up in our age, is becoming widespread in many places in our daily lives (Birişçi and Karal, 2010).

Today, education systems need to educate individuals who are free, creative, scientific thinking, questioning events, who are aware of the problems, who have the ability to make decisions, who have the ability to produce information and who have the confidence of self-confidence instead of transferring information instead of educating individuals who are loaded with knowledge based on memorization using traditional teaching methods (Yavuz and Coşkun, 2008). In order to do this, the educational systems that have this duty must be able to renew, change and transform themselves. In order to realize this, innovations in Information and Communication Technologies need to be integrated into educational systems. Today, SMART Boards are one of the most important tools in the context of effective integration of education technologies into classroom environment.

The fact that the board screen has an interactive touch sensitive structure allows the student and teacher to intervene on the screen, make changes to what is done and record what is done. Audio clips, video and animation shows, colors, images, screen and magnification reduction, such as highlighting opportunities makes it possible to make lessons more visual and more vivid (Erduran and Tataroğlu, 2009). With SMART Board, teachers can enrich their teaching with a variety of teaching strategies and techniques, thereby increasing student involvement, motivation, participation and collaboration. Türel and Johnson (2012) stated that the real success of the SMART Board depends on the use of the teacher in learning environments.

Students will have an advanced thinking ability in effective use of technology. The course should be careful and prepared and should have a good technical support system for the efficiency of the learning process. For this, national research and development support should be. Software should be developed about the most effective and necessary use of technology. The state should create at least one center for these researches and allocate an appropriate budget (Hamdan, Al-Qirim and Asmar, 2012).

SMART Board used in the world since 1997 have been widely used in recent years in the scope of FATİH Project in our country. Studies on this subject have been conducted mostly for the success and attitude of the students in science class. In addition to this research, the effect of using SMART Board on students ' attitudes towards the environment will be investigated. Therefore, the research is the basis for subsequent studies.

Research Problem

What is the impact of SMART Board applications on students ' attitude towards the environment in science lesson?

Sub-problems

Answer to the following sub-problems related to the problem sentence of the research:

1. Do the environmental attitude scores of the experimental and control groups differ in the pre-test?
2. Do the environmental attitude scores of the control group differ from pre-test and post-test?
3. Do the environmental attitude scores of the experimental group differ from pre-test and post-test?
4. Do the environmental attitude scores of the experiment and control groups differ in the post-test?

Hypotheses

The hypotheses used in this research are expressed for the answer of the research problem and its sub-problems.

1. There is no significant correlation between the environmental attitude scores of the experimental and control groups in the pre-test.
2. There is no significant correlation between the environmental attitude scores of the control group in pre-test and post-test.
3. There is a significant correlation between the environmental attitude scores of the experimental group in the pre-test and the end-test.

4. There is a significant correlation between the environmental attitude scores of the experimental and control groups in the end-test.

Method

In this study, the effect of SMART Board use on students ' attitude toward the environment in human and environmental units was investigated. Quasi-experimental design was used in the study. The research consists of 42 students studying in the seventh grade of two secondary schools affiliated to MEB in Hadim District of Konya Province.

Table 1. Number of students in groups

Group	Male	Female	N
Experimental	12	9	21
Control	10	11	21
Total	22	20	42

The Environmental Attitude Scale developed by Yücel and Özkan (2014) was used in the study. The scale is of five point likert type and consists of two sub-dimensions. The first subscale includes 14 items and the attitude includes the "Behavior" dimension. “Never”, “rarely”, “occasionally”, “mostly” and “always” are scaled and scored as 1, 2, 3, 4, and 5 respectively. The second sub-scale includes the dimensions of the attitude “Idea”, “Feeling”, “Willingness to Proceed in Action” and consists of 21 items. The average of the responses to the environmental attitude scale was calculated for both the whole scale and for each dimension.

“Human and Environment” unit topics were lectured in both groups for 4 weeks. The subjects were explained to both groups by the researcher. In this way, individual differences in teaching skills of the teacher were eliminated and the teaching was made more effective. The subjects were explained to the experimental group using SMART Board. The control group was told by using the experiments and activities in the textbook according to the Science Curriculum.

The Environmental Attitude Scale was applied to the experiment and control group as both pre-test and post-test. Data obtained from the study were analyzed by SPSS 22 statistical program. The level of significance was determined as 0.05.

Before starting the study, “independent t-test” was used to compare two independent groups, whether there was a significant correlation between the experimental group and control group’s test results of the Environmental Attitude Scale applied to both group. The Control and Experimental Group's Environmental Attitude Scale was determined by applying the "dependent t-test" used to compare two measurements from a single group to determine whether there is a significant relationship between pre-test and post-test results. The "independent t-test" was used to compare two independent groups to determine whether there was a significant correlation between the post-test results applied to the experimental and control groups.

Findings

Hypothesis 1: There is no significant correlation between the environmental attitude scores of the experimental and control groups in the pre-test.

In the analysis of Environmental Attitude Scale (EAS) scores, the different parts of the test were analyzed among themselves because of the fact that the test consisted of two parts. Finally, the test was analyzed in general and the results were obtained. In the analysis of the tests, the average scores of the substances were used to facilitate analysis rather than the total scores of the substances.

Environmental Attitude Scale Behavior Dimension applied to control and experiment groups after analysis of pre-test results, pre-test score averages, standard deviations (SD), degree of freedom (df) and p values were given in Table 2. The environmental attitude test applied as a pre-test is close to each other in the behavior dimension ($\bar{X}_{control}$=3, 02; $\bar{X}_{experimental}$=2, 67).

Table 2. Environmental attitude scale behavior dimension control and experimental groups pre-test data

Group	N	$\bar{X}$	SD	df	t	p
Control group pre-test	21	3,02	0,54	40	1,83	,075
Experimental group pre-test	21	2,67	0,67			

As shown in Table 2, there is no significant difference between the groups (t = 1.83, p = .075, p>, 05). This result shows that the attitudes towards the environment before the study are close to each other in the behavioral dimension of the experiment group and the control group where the same subject is handled with Science Curriculum. According to this, the scores of both groups ($\bar{X}_{control}$=3, 02; $\bar{X}_{experimental}$=2, 67) are close to each other and since there is no significant difference between them, it can be said that the purpose of the research is appropriate.

Environmental Attitude Scale Idea, Feeling and Willingness to Proceed in Action Dimension applied to control and experiment groups after analysis of pre-test results, pre-test score averages, standard deviations (SD), degree of freedom (df) and p values were given in Table 3. The environmental attitude test applied as a pre-test is close to each other in the behavior dimension ($\bar{X}_{control}$=3, 60; $\bar{X}_{experimental}$=3, 57).

Table 3. Environmental attitude scale idea, feeling and willingness to proceed in action dimension control and experimental groups pre-test data

Group	N	$\bar{X}$	SD	df	t	p
Control group pre-test	21	3,60	0,53	40	,171	,865
Experimental group pre-test	21	3,57	0,60			

As shown in Table 3, there is no significant difference between the groups (t=, 171, p=, 865; p>, 05). This result shows that the attitudes towards the environment before the study are close to each other in the idea, feeling and willingness to proceed dimension of the experiment group and the control group where the same subject is handled with Science Curriculum. According to this, the scores of both groups ($\bar{X}_{control}$=3, 57; $\bar{X}_{experimental}$=3, 60) are close to each other and since there is no significant difference between them, it can be said that the purpose of the research is appropriate.

Environmental Attitude Scale applied to control and experiment groups after analysis of pre-test results, pre-test score averages, standard deviations (SD), degree of freedom (df) and p values were given in Table 4. The environmental attitude test applied as a pre-test is close to each other ($\bar{X}_{control}$=3, 36; $\bar{X}_{experimental}$=3, 21).

Table 4. Environmental attitude scale control and experimental groups pre-test data

Group	N	$\bar{X}$	SD	df	t	p
Control group pre-test	21	3,36	0,36	40	1,11	,273
Experimental group pre-test	21	3,21	0,50			

As shown in Table 4, there is no significant difference between the groups (t=1, 11, p=, 273; p>, 05). This result shows that the pre-study environmental attitudes between the experimental group and the control group are close to each other. According to this, the scores of both groups ($\bar{X}_{control}$=3, 36; $\bar{X}_{experimental}$=3, 21) are close to each other and since there is no significant difference between them, it can be said that the purpose of the research is appropriate.

It was observed from the analyses that the attitudes of the experimental group and control group towards the environment were not statistically different in the behavioral dimension and the idea, feeling and willingness to proceed dimension. This shows that the two groups are appropriate for the study. Hypothesis 1 accepted.

Hypothesis 2: There is no significant correlation between the environmental attitude scores of the control group in pre-test and post-test.

After the analysis of pre-test and post-test scores applied to the control group, the mean scores, standard deviations (SD), degree of freedom (df) and p value were given in Table 5. The mean of pre-test scores of the control group students was $\bar{X}_{control}$=3, 02; the post-test scores were $\bar{X}_{control}$=3, 40.

Table 5. Environmental attitude scale behavior dimension control group pre-test and post-test data

Group	N	$\bar{X}$	SD	df	t	p
Control group pre-test	21	3,02	0,54	20	2,23	,037
Control group post-test	21	3,40	0,58			

There was a significant difference between the control group pre-test and the post-test (t=2, 23, p=, 037; p<, 05). The results show that the students ' attitudes towards the environment increased in the behavior dimension at the end of the study of the science curriculum in the control group. It can be said that the science curriculum develops students ' attitudes towards the environment in a behavior dimension.

After the analysis of pre-test and post-test scores applied to the control group, the mean scores, standard deviations (SD), degree of freedom (df) and p value were given in Table 6. The mean of pre-test scores of the control group students was $\bar{X}_{control}$=3, 60; the post-test scores were $\bar{X}_{control}$=3, 92.

Table 6. Environmental attitude scale idea, feeling and willingness to proceed in action dimension control group pre-test and post-test data

Group	N	$\bar{X}$	SD	df	t	p
Control group pre-test	21	3,60	0,53	20	1,79	,088
Control group post-test	21	3,92	0,52			

There was a no significant difference between the control group pre-test and the post-test (t=1, 79 p=, 088; p>, 05). It is understood from these results that at the end of the implementation of the science curriculum in the control group, the attitudes of the students towards the environment did not create a statistically significant difference in the dimension of idea, feeling and willingness to proceed.

After the analysis of pre-test and post-test scores applied to the control group, the mean scores, standard deviations (SD), degree of freedom (df) and p value were given in Table 7. The mean of pre-test scores of the control group students was $\bar{X}_{control}$=3, 36; the post-test scores were $\bar{X}_{control}$=3, 71.

Table7. Environmental attitude scale control group pre-test and post-test data

Group	N	$\bar{X}$	SD	df	t	p
Control group pre-test	21	3,36	0,36	20	2,63	,016
Control group post-test	21	3,71	0,46			

As shown in Table 7, there is a significant difference between the groups (t = 2, 63, p =, 016; p <, 05). It is understood from these results that the Science Curriculum produced a statistically significant difference in the students' attitudes toward the environment at the end of the control group. According to these results, hypothesis 2 was rejected.

Hypothesis 3: There is a significant correlation between the environmental attitude scores of the experimental group in the pre-test and the end-test.

After the analysis of pre-test and post-test scores applied to the experimental group, the mean scores, standard deviations (SD), degree of freedom (df) and p value values were given in Table 8. Students in the experimental group pre-test average score on the $\bar{X}_{experimental}$=2, 67; post-test average score on the $\bar{X}_{experimental}$=3, 66 as were found.

Table 8. Environmental attitude scale behavior dimension experimental group pre-test and post-test data

Group	N	$\bar{X}$	SD	df	t	p
Experimental group pre-test	21	2,67	0,67	20	4,49	,000
Experimental group post-test	21	3,66	0,88			

As shown in Table 8, there is a significant difference between the groups (t = 4.49, p = .000, p <.05). It is understood from these results that the attitudes of the students towards the environment in the experimental group applied to SMART Board applications showed an increase in the behavior of the students. It can be said that SMART Board applications have improved students' attitudes toward the environment in dimension of behavior.

After the analysis of pre-test and post-test scores applied to the experimental group, the mean scores, standard deviations (SD), degree of freedom (df) and p value values were given in Table 9. Students in the experimental group pre-test average score on the $\bar{X}_{experimental}$=3, 57; post-test average score on the $\bar{X}_{experimental}$=4, 04 as were found.

Table 9. Environmental attitude scale idea, feeling and willingness to proceed in action dimension experimental group pre-test and post-test data

Group	N	$\bar{X}$	SD	df	t	p
Experimental group pre-test	21	3,57	0,60	20	2,66	,015
Experimental group post-test	21	4,04	0,62			

As shown in Table 9, there is a significant difference between the groups (t = 2, 66, p =, 015; p <, 05). It is understood from these results that there was a statistically significant difference in the dimension of the students ' attitudes towards the environment idea, feeling and willingness to proceed in action in the experimental group applied to SMART Board applications. It can be said that SMART Board applications have improved students' attitudes toward the environment in dimension of idea, feeling and willingness to proceed in action.

After the analysis of pre-test and post-test scores applied to the experimental group, the mean scores, standard deviations (SD), degree of freedom (df) and p value values were given in Table 10. Students in the experimental group pre-test average score on the $\bar{X}_{experimental}$=3, 21; post-test average score on the $\bar{X}_{experimental}$=3, 89 as were found.

Table 10. Environmental attitude scale experimental group pre-test and post-test data

Group	N	$\bar{X}$	SD	df	t	p
Experimental group pre-test	21	3,21	0,50	20	4,31	,000
Experimental group post-test	21	3,89	0,60			

As shown in Table 10, there is a significant difference between the groups (t = 4.31, p = .000; p <. 05). It is understood from these results that there was a statistically significant difference in the attitudes of the students towards the environment in the experimental group in which SMART Board applications were applied. According to these results, hypothesis 3 was accepted.

Hypothesis 4: There is a significant correlation between the environmental attitude scores of the experimental and control groups in the end-test.

Environmental Attitude Scale Behavior Dimension are applied to the experimental and control groups post-test scores of "independent groups t-test after analysis, the mean score, standard deviations (SD), degree of freedom (df), and p value are given in Table 11.

Table 11. Environmental attitude scale behavior dimension control and experimental groups post-test data

Group	N	$\bar{X}$	SD	df	t	p
Control group post-test	21	3,40	0,58	40	1,13	,265
Experimental group post-test	21	3,66	0,88			

Students in the control group post-test average score of $\bar{X}_{control}$ =3, 40; students in the experimental group post-test average score on the $\bar{X}_{experimental}$ =3, 66 as were found. There was no statistically significant difference between the scores of the two groups (t=1, 13, p=, 265; p>, 05).

Environmental Attitude Scale Idea, Feeling and Willingness to Proceed in Action Dimension are applied to the experimental and control groups' post-test scores of "independent groups t-test after analysis, the mean score, standard deviations (SD), degree of freedom (df), and p value are given in Table 12.

Table 12. Environmental attitude scale idea, feeling and willingness to proceed in action dimension control and experimental groups post-test data

Group	N	$\bar{X}$	SD	df	t	p
Control group post-test	21	3,92	0,52	40	,67	,502
Experimental group post-test	21	4,04	0,62			

Students in the control group post-test average score of $\bar{X}_{control}$ =3, 92; students in the experimental group post-test average score on the $\bar{X}_{experimental}$ =4, 04 as were found. There was no statistically significant difference between the scores of the two groups (t=, 67, p=, 502; p>, 05).

Environmental Attitude Scale are applied to the experimental and control groups' post-test scores of "independent groups t-test after analysis, the mean score, standard deviations (SD), degree of freedom (df), and p value are given in Table 13.

Table 13. Environmental attitude scale control and experimental groups post-test data

Group	N	$\bar{X}$	SD	df	t	p
Control group post-test	21	3,71	0,46	40	1,05	,296
Experimental group post-test	21	3,89	0,60			

Students in the control group post-test average score of $\bar{X}_{control}$ =3, 71; students in the experimental group post-test average score on the $\bar{X}_{experimental}$ =3, 89 as were found. There was no statistically significant difference between the scores of the two groups (t=1, 05, p=, 296; p>, 05).

Conclusion

In this study, it was investigated how SMART Board usage affects students ' attitudes towards the environment. Environmental Attitudes Scale was used to examine students ' attitudes towards the environment. Before starting the research, this test was applied to measure the environmental attitudes in both groups. In this test, the attitude toward a general environment was measured, as well as the dimension of behavior, idea, feeling and willingness to proceed in action. After the application, the same test was applied to both groups as the post-test.

The Environmental Attitude Scale scores of the students in the experiment and control groups have shown progress. There was a significant difference between the pre-test and post-test scores of the Environmental Attitude Scale in both the experimental group and the control group. It was understood that there was no significant difference when the scores of the Environmental Attitude Scale pos-tests of the experimental and control group students were compared. The results of the study revealed that students ' attitudes and behaviors were more difficult to achieve than cognitive success. In addition, the activities on the SMART Board were not as effective as expected in developing their attitudes towards the environment as they were not sincere to the students.

Recommendations

1. This study was conducted with a limited number of students. Researchers can study the results by applying this study to wider student communities.
2. This study lasted four weeks and 4 hours per week. Researchers can explore the effects of using SMART Board by spreading it over a wider period of time.
3. Researchers develop themselves on the use of SMART Board and reach or plan more activities will affect the results of the research.
4. Researchers can study students ' attitudes towards the environment by planning different SMART Board activities.
5. The use of SMART Board can be compared to other student-centered methods and techniques.
6. SMART Board students ' attitude towards the environment by repeating other research innovations can be gained in the literature.
7. They can explore the difference between using SMART Board and other technology-based methods.
8. Teachers can plan or design their own SMART Board applications and events.
9. Teachers can participate in in-service training to make SMART Board use more effective.
10. Teachers can meet students with more resources and questions through their z-books. In this way, they can save both paper and time.

Notes

This study was produced from the master's thesis prepared by the first author under the guidance of the second author.

References

Birişçi, S., & Karal, H. (2015). Effect of Collaborative Studies on Prospective Teachers' Creative Thinking Skills while Designing Computer Based Material. Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi, 12(2), 203-219.

Erduran, A., & Tataroglu, B. (2009). Comparison of science and mathematics teachers' views regarding use of smart board in education. In 9th international educational technology conference (IETC2009), Ankara, Turkey.

Hamdan, K., Al-Qirim, N., & Asmar, M. (2012, March). The effect of smart board on students behavior and motivation. In Innovations in Information Technology (IIT), 2012 International Conference on (pp. 162-166). IEEE.

Kaya, Z. (2002). Uzaktan Eğitim. Ankara: Pegem Yayıncılık.

Türel, Y. K. & Johnson, T. E. (2012). Teachers' belief and use of interactive whiteboards for teaching and learning. Educational Technology & Society, 15(1), 381–394.

Yavuz, S., & Coskun, A. E. (2008). Attitudes and perceptions of elementary teaching through the use of technology in education. Hacettepe Universitesi Egitim Fakultesi Dergisi-Hacettepe University Journal Of Education, (34), 276-286.

Yücel, E. Ö., & Özkan, M. (2014). Development of Environmental Attitudes Scale for Secondary School Students. Uludağ Üniversitesi Eğitim Fakültesi Dergisi, 27(1).

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ISRES Publishing

The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 175 - 177

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Training of Foreign Students Under the Modern Professional Preparation of Qualified Doctor

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Abstract: The training of a qualified doctor is the main task of a higher educational institution. When teaching medicine to foreign students it is important to take into account the ethno-social problems that arise at the stage of practical training of a doctor in modern conditions. The purpose of the work is to introduce into the system of training foreign students’ clinical situational tasks, the closest to the real cases of medical practice, which will improve the quality of mastering the discipline by foreign students of the 4th year and obtain the necessary general levels of theoretical knowledge, practical skills and abilities. For the practical stage of studying foreign students we offer situational clinical tasks in accordance with the studied topic, which indicates the previous diagnosis, as well as the minimum amount of laboratory and / or instrumental data studies. The experience of using clinical situational tasks for the practical training of foreign students suggests that this approach is optimal and allows you to effectively form the necessary level of knowledge and skills for students for the next general medical practice.

Keywords: Training students, Professional preparation, Qualified doctor

Introduction

The training of a qualified doctor is the main task of a higher educational institution. When teaching medicine to foreign students it is important to take into account the ethno-social problems that arise at the stage of practical training of a doctor in modern conditions.

In preparation of the student replacement of an estimated vector in the control of knowledge over existing volumetric parameters (an estimation on offset and examination) - before management and quality assurance of training will be powerful at studying discipline on each practical employment, adhering to the unified scheme with attraction of the developed textbooks.

The organization of educational process according to Bologna Convention giving to us to reorient this form of a passive method of training of students, actually from the lecture - informative to individually - the differentiated personal form, where ideology of lections transition from the educational technology "to drive in of knowledge" to technology "the self-education organizations" medical students. And for of foreign the intern-surgeons it’s important to mastering of surgical manipulation and stages of surgical interventions in treating the most common surgical diseases or providing an emergency assistance in case of emergency conditions.

Development of modern surgery is impossible without modern techniques, including laparoscopic technology, so it’s necessary to prepare medical interns to work on equipment that meets the time.

This requires to reconstruct the process of teaching surgery both students and medical interns towards a positive effect - mastering the full range of theoretical knowledge and practical skills with the help of modern equipment.

Method

The purpose of the work is to introduce into the system of training foreign students' clinical situational tasks, the closest to the real cases of medical practice, which will improve the quality of mastering the discipline by foreign students of the 4th year and obtain the necessary general levels of theoretical knowledge, practical skills and abilities. For the practical stage of studying foreign students we offer situational clinical tasks in accordance with the studied topic, which indicates the previous diagnosis, as well as the minimum amount of laboratory and / or instrumental data studies.

Thus, the substantial module "Surgical Gastroenterology and Proctology" includes "Syndrome of chronic pain in the upper region of abdominal cavity", "Syndrome of mechanical jaundice", "Syndrome of an acute pain in perianal area", "Syndrome of rectal prolepses" and "Diarrheic-inflammatory syndrome", combining similar diseases or their complications in the form of so-called educational elements, where, for example, a practice training for "Syndrome acute pain in perianal region" contains "Acute hemorrhoids", "Acute anal fissures", "Acute paraproctitis" and "Inflammation of the epithelial coccygeal passage".

This approach is appropriate to expediently use the time of practical training, examine patients according to pathological syndrome, mastering the skills in classes with medical simulators, and perform differential diagnosis with the definition of a rational treatment program.

To support the learning process developed by the principles of credit-modular system using multimedia lectures, the textbook "Surgery" in 3 volumes (5 books) [4], in this time –process translated this books on English, methodological guide of development for foreign students and of foreign interns, methodological guide of development for teachers, hand book and individual plans for students and interns, journal of the teacher.

For the practical training used division's computer class (10 computers) - for computer testing of students and interns, two classes of medical mannequins and simulators (products firm "3B Scientific") - for acquiring and mastering practical skills, supervision of patients in the surgical department, supervised and theoretical survey in training rooms.

For the interns besides the basic work in the surgical department with patients it's necessary to mastery of the operational equipment in operation and manipulation rooms, as well as mastering of mini invasive surgery technology in the learning center "Endoscopic technologies in medicine".

Results and Discussion

After each study to of foreign students' time for independent development of practical skills by preparation for following study is allocated.

Thus, the substantial module "Surgical Gastroenterology and Proctology" includes "Syndrome of chronic pain in the upper region of abdominal cavity", "Syndrome of mechanical jaundice", "Syndrome of an acute pain in perianal area", "Syndrome of rectal prolepses" and "Diarrheic-inflammatory syndrome", combining similar diseases or their complications in the form of so-called educational elements, where, for example, a practice training for "Syndrome acute pain in perianal region" contains "Acute hemorrhoids", "Acute anal fissures", "Acute paraproctitis" and "Inflammation of the epithelial coccygeal passage".

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Conclusion

The experience of using clinical situational tasks for the practical training of foreign students suggests that this approach is optimal and allows you to effectively form the necessary level of knowledge and skills for students for the next general medical practice.

References

Березницький Я.С., Сулима В.П., Хапатько Г.Ю., Дука Р.В., Маліновський С.Л., Верхолаз І.Л., Куриляк С.М. Досвід викладання хірургії студентам четвертого курсу за кредитно-модульною системою // Хірургія України.-2008.-№4(28), додаток 1. – С.14-15.

Хірургія. Під ред. Я.С. Березницького, М.П. Захараша, В.Г. Мішалова. ІІ том. РВА «Дніпро-VAL»: Дніпропетровськ. – 2007 - 628с.

Конвенция о признании квалификаций, относящихся к высшему образованию в Европейском регионе. – Лиссабон, 11 апреля 1997.

Положення про організацію навчального процесу у вищ. навч. закладах: Наказ Мін. осв. і науки України від 02.06.1993, №161.

Про особливості впровадження кредитно-модульної системи організації навчального процесу: Наказ Мін. осв. і науки України від 20.10.2004.

Уніфіковані клініко-статистичні класифікації хвороб органів травлення (відомча інструкція). Дзяк Г.В., Березницький Я.С., Філіпов Ю.О. з співавт. – К.: "Дніпро-VAL". – 2004. – 94с.

The European higher education area. Joint Declaration of the European Ministers of Education. Bologna, June 19, 1999.

Training of surgery for a students and preparation of surgeons-interns using medical simulators. Dzyak G.V., Bereznyts`kyy Ya.S., Sulyma V.P., Duka R.V. //Istanbul, Turkey. – Proceeding Book (Volume I) 11th IETC. – 2011. – p: 1204-1207.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 178-181

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Why Do I Need Medical Students for an Individual Plan of a Training Process?

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Abstract: Individual plan of a training process for medical students contains:
1. Theme and list of training elements, content modules and modules.
2. Forms of control on individual elements of the educational process.
3. Reference balls for individual and total elements of the educational process.
4. Actual scores received by the student for his personal control of the level of knowledge for individual learning elements and the total level.
5. The individual plan should become a motivating factor for improving knowledge of the individual components of the curriculum.
6. Its content should be used in self-preparation of the student for the lesson.

Medical students in the course of training should analyze the mistakes made and fill in the gaps in their knowledge, as self-control is the basis of cognitive activity, reasonable independence, disciplines the student, develops a critical attitude towards oneself, being motivated to better education. The results indicate increase objectivity in the control of knowledge from teachers and students to increase interest in teach a subject that is allowed to integrate in medical education and, in future, in practical public health of Ukraine and other countries. Diagnosis is based on the comparison of resembling signs of a disease, in an examined patient, with manifestations of all the diseases with similar clinical presentation.In consideration of the importance of preparing qualified specialists, it's natural to increase quality of education in medical institution, so it's necessary to embody the credit transfer system in training course of surgery in Ukraine by preparation physician – general practitioners.

Keywords: Individual plan, Training process, Medical students

Introduction

Individual plan of a training process for medical students contains:
1. Theme and list of training elements, content modules and modules.
2. Forms of control on individual elements of the educational process.
3. Reference balls for individual and total elements of the educational process.
4. Actual scores received by the student for his personal control of the level of knowledge for individual learning elements and the total level.
5. The individual plan should become a motivating factor for improving knowledge of the individual components of the curriculum.
6. Its content should be used in self-preparation of the student for the lesson.

Such statement of a question, the higher medical education of independent Ukraine to return to the solution of a difficult pedagogical task - urgently and systemically to pass from classical methods of teaching of subject matters to post-classical that would allow at catastrophically accruing volume of medical information various organizations' and administrative and medical (preventive, diagnostic, medical, rehabilitation), and also scientific genesis to turn it into knowledge of the student, and the theoretical knowledge received by the same student, to transform to his professional skills and abilities.

All this together outlines the importance of the scientific and methodical research executed by us and does it actual in own contents. Such system and methodical transition would allow forming at the same time among medical students and motives to aspiration to study, to ability and desire to work, investigate and learn.

Taking into account that the level of qualification of the doctor is in the first place in various gradational system of educational societies it's understood the necessity to improve the quality of the doctor in institutes of higher education, in which directed implementation of the credit-module system to the educational process.

Preparation of doctors of the general practice is the principal task of the medical institution of higher education, and therefore the proper teaching of surgery in the whole complex of other disciplines will create conditions for quality medical practice doctor in the future, especially for those professionals who plan to work as surgeons in around world of countries.

The doctors of the general medical practice tasks determinates basic requirements of scope of knowledge and practical skills for graduating of foreign student of institute of higher education of IV level of accreditation: goal-directed methodic algorithm of questioning of the patient (getting anamnesis), physical examination, substantiation of provisional diagnosis, determinate algorithm of additional methods of investigations with analysis of received results, differential diagnosis, forming clinical diagnosis, substantiation of treatment program and its implementation.

Method

Medical students in the course of training should analyze the mistakes made and fill in the gaps in their knowledge, as self-control is the basis of cognitive activity, reasonable independence, disciplines the student, develops a critical attitude towards oneself, being motivated to better education.To implement the system of planning, monitoring and evaluation of the education quality for a real degree of assimilation of foreign students with specific components of the program during the academic year of surgery training and discipline for module "Abdominal surgery" in general based on the cumulative number of ranking points for the European Credit Transfer System (ECTS).

This will improve the quality of learning discipline among the four-year of foreign students of enrolled this year, and develop common indicators for professionally-oriented exam after 6 year of study to get a general level of theoretical and practical knowledge and skills of foreign physicians interns of surgery. The structured, multifactor planning of the educational process and implementation of various forms of staging control were conducted. Based on the standard curriculum and learning plan was created the Working program that regulates specific activities by teachers and students to achieve as a theoretical and practical knowledge required for this sequence of technological resources and action items using the credit-module system. The calculated threshold standards levels of education (sum of estimates after the module translates the 200-point scale ECTS) and communicated to students to stimulate their enthusiasm for learning to the maximum level.

Main objective of this passive method of training – lectures, is formation of an orientation basis for further assimilation by students of a training material, then when a source in this method of training is the word of the teacher that directly reflects its language of culture pedagogical professionalism. Besides, today lecture - as the passive method of study strengthened by such methods of presentation as an illustration (tables, schemes, presentations and so forth) and demonstration (slides, video movies).

It is important to note that in the course of application of a lecture method in the course of training students act as "object" of study - as passive listeners who have to acquire and recreate a lecture material which moves them the teacher - a source of knowledge.

The Department of Surgery № 1 (in 2017 – 95 years founded) of the State Organization "Dnipropetrovs'k Medical Academy Ministry Health of Ukraine" (in 2016 – 100 years founded) was conduct structured, multiple planning of the study process and the use of different forms of the staging control. Taking into account the

Standard program of the discipline, curriculum, working program for the department was create the specific actions by teachers, of foreign students and of foreign interns of surgery to achieve theoretical and practical knowledge, necessary resources and sequence of technological operations with the use of credit-modular system.

Thus, there were additionally created classes for training with medical mannequin and simulators to master the practical skills of foreign students in educational time and time for self-preparation on products firm "3B Scientific".

In 2011 on Department of Surgery № 1 of the State Organization "Dnipropetrovs'k Medical Academy Ministry Health of Ukraine" was founded Ukraine's first training center "Endoscopic technologies in medicine", bases on which of foreign interns learn to use mini invasive operating technologies in surgery. This center was open thanks to involving special training and instruments of the company "Karl Storz-Endoscope" and "Ethicon Endosurgery" (subsection "Ethicon a Johnson and Johnson Company").

Nosological principle of training that exists in most clinical departments, unfortunately, does not meet the practical work of a doctor, so we came to forming the curriculum by the syndrome principle: a practical training combines several pathological conditions, with oriental features, such as the module "Abdominal surgery", consists of two modules of content (substantial modules): "Urgent abdominal surgery" and "Surgical Gastroenterology and Proctology".

Thus, the substantial module "Surgical Gastroenterology and Proctology" includes "Syndrome of chronic pain in the upper region of abdominal cavity", "Syndrome of mechanical jaundice", "Syndrome of an acute pain in perianal area", "Syndrome of rectal prolepses" and "Diarrheic-inflammatory syndrome", combining similar diseases or their complications in the form of so-called educational elements, where, for example, a practice training for "Syndrome acute pain in perianal region" contains "Acute hemorrhoids", "Acute anal fissures", "Acute paraproctitis" and "Inflammation of the epithelial coccygeal passage".

Results and Discussion

The results indicate increase objectivity in the control of knowledge from teachers and students to increase interest in teach a subject that is allowed to integrate in medical education and, in future, in practical public health of Ukraine and other countries. Experience of using credit-modular system in teaching and measuring knowledge of surgery since 2005 suggests that this approach is effective.

Received results underscore the increased objectivity in the control of knowledge on the part of teachers' interest and increasing of foreign students and of foreign medical interns' interest to master a subject, that allowed to prepare a general practitioner in surgery and surgeons, and integrate in the future in practical public health in worldwide.

Conclusion

Diagnosis is based on the comparison of resembling signs of a disease, in an examined patient, with manifestations of all the diseases with similar clinical presentation. In consideration of the importance of preparing qualified specialists, it's natural to increase quality of education in medical institution, so it's necessary to embody the credit transfer system in training course of surgery in Ukraine by preparation physician – general practitioners. It is necessary the cooperation of the educational institution, clinical department and companies - manufacturers of medical and educational equipment, as in our case, working with "3B Scientific" and "Karl Storz-Endoscope", "Ethicon Endosurgery" (subsection "Ethicon a Johnson and Johnson Company").

Use of medical simulators and training mannequins for acquiring practical skills and new technologies of operative interventions using modern endoscopic equipment, tools, and simulators allows imitating the real clinical situation during operative interventions and learning steps to resolve it.

References

Березницький Я.С., Сулима В.П. Викладання факультетської хірургії в експериментальних умовах переходу на кредитно-модульну систему навчання// Вісник Української стоматологічної медичної академії. Акт. пробл. сучасн. медицини. – 2006, т. 6, вип. 1-2 (13-14). – С. 294-297.

Дзяк Г.В., Березницький Я.С., Кабак Г.Г., Люлько І.В. Організація учбового процесу в умовах переходу на кредитно-модульну систему навчання // Мед. перспективи.–2005.–Том X, №1.–С.7-16.

Хірургія (практичні заняття). Березницький Я.С., Сулима В.П., Товстолиткін Г.Є., Дука Р.В., Маліновський С.Л., Куриляк С.М. Навч. посіб. для студ. – Дніпропетровськ, 2006.–127с**.**

Методы исследования и манипуляции в клинической медицине. Под ред. Г.В. Дзяка и Я.С. Березницкого. – К.: «Здоров`я». – 164с.

Про запровадження у вищих навчальних закладах навчальної дисципліни "Вища освіта і Болонський процес": Наказ Мін. осв. і науки України від 21.05.2004, №414.

Складові галузевих стандартів вищої освіти напрямку підготовки 1101 "Медицина" освітньо-кваліфікаційного рівня "спеціаліст" у вищих навч. закладах III-IV рівнів акредитації України.– К.: 2002.

Magna Charta Universitatum. Bologna, Italy, September 18, 1988.

Surgery. Practical trainings. Manual for students. Ya.S. Bereznyts`kyy, V.P. Sulyma, G.E. Tovstolytkin, G. Y. Hapatko, R.V. Duka, S.L. Malinovskyj, I.L. Verholaz, I.D. Kryzhanovskyj, S.M. Kurylyak, O. Zeleniuk. – Dnipropetrovsk. – 2007. – 114p.

Education and training on surgery of foreign students and reparation of foreign surgeons-interns with use of medical simulators. Bereznyts`kyy Ya.S., Sulyma V.P.// Istanbul, Turkey. - Abstract book ICEC. – 2012. – p: 24.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 182-192

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Investigation of the Information, Attitude and Behaviors of the Conservatory Secondary School Students around the Environment

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Abstract: In the survey, it was aimed to determine the level of environmental awareness (knowledge, behavior and attitude) of the sixth, seventh and eighth grade students in the conservatory middle school level. The study group consists of 76 students, 62 of which are from middle school and 14 are from ballet. For this purpose, a five-point Likert-type environmental awareness questionnaire developed by Erten was used. The 20 items of this questionnaire are environmental information, the 20 items are the behavior towards the environment and the last 20 items are the items prepared to determine the attitude toward the environment. The answers given by the students to the questionnaire were analyzed and interpreted statistically with the SPSS program. As a result of the analysis, it was determined that conservatorial middle school students' attitudes towards the environment and environmental information are at a higher level than the average behavior of their surroundings. In addition, it has been determined that the attitudes and knowledge levels of the students have not much influence on the beneficial behaviors of the students.

Keywords: Conservatory, Secondary school students, Environmental awareness

Introduction

The environment in which the living beings living on the earth continue their lives, affected by the environment in which they live and affect the environment, and the lives of other creatures like himself and others are called the environment (Güler, 2009). In order to survive all living creatures, it is necessary to adapt to the conditions of the environment, and in the same way nature interacts with all living things to provide balance. But in particular, people used the environment they lived in, not at a certain level but in a way that would be entirely suited to their own interests.

This situation has caused the balance between the environment and the living beings to deteriorate and reveal environmental problems. In other words, the root of the environmental problems began with the emergence of the human being. Because human beings have used nature and nature to despise the resources they have offered them, and by doing so they will almost cause them to be consumed, making the resources disappear (Özcan, 2016).

If we define the concept of environmental problems, we can say that it is the name of the global problem that negatively affects the life and behavior forms of all living things regardless of religion, language, race, sex, age, position difference (Erten, 2012). Due to the selfish behaviors that people have shown themselves in their minds, the natural environment, which is getting polluted and almost disappearing day by day, has started to lose its ability to renew itself (Gülay- Ogelman and Güngör, 2015).

In addition, industrial and medical waste has increased with the increase of industrialization. In addition to these wastes, wastes made from materials such as paper, glass, plastic and metal, which are found in the domestic waste category, also increase the environmental pollution. Increasing environmental problems have led to the

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

rise of global warming, the disappearance of many resources, the destruction of the health of living beings, particularly human health, and the destruction of natural resources (Ersoy-Quadır, 2015).
Erten (2003) listed environmental problems under six main headings as follows:

1. **Air Pollution**

Causes: Consumed fossil fuels, incineration of garbage, radioactive rays
Results: Acid rain, global warming, ozone layer damage, fog formation

2. **Water Pollution**

Causes: Overfishing, uncleaned domestic and industrial wastewater, tanker accidents, chemicals, all pests left by the sea
Results: Pollution of rivers, collective deaths of marine living, pollution of drinking water, increase of epidemic diseases

3. **Soil Pollution**

Causes: Piles of garbage and garbage, acid rain, fertilization studies, pesticides
Results: Increase of heavy metal density in the soil, change of pH value of soil, formation of source of disease makers, deterioration of aesthetic

4. **The Survival of Animals and Plant Species**

Causes: acid rain, plundering of rain forests, monocultural agriculture and forestry, direct removal of plants and animals, pesticides
Results: Continued increase of natural disasters due to the disappearance of many plant and animal species, the destruction of forests, the change of climates

5. **Change of Climate**

Causes: The disappearance of tropical rain forests, unlimited consumption of fossil fuels, the use of FKC gases
Results: The formation of the greenhouse effect (global warming), the arrival of harmful heat on the earth from the ozone layer

6. **Trash Problems**

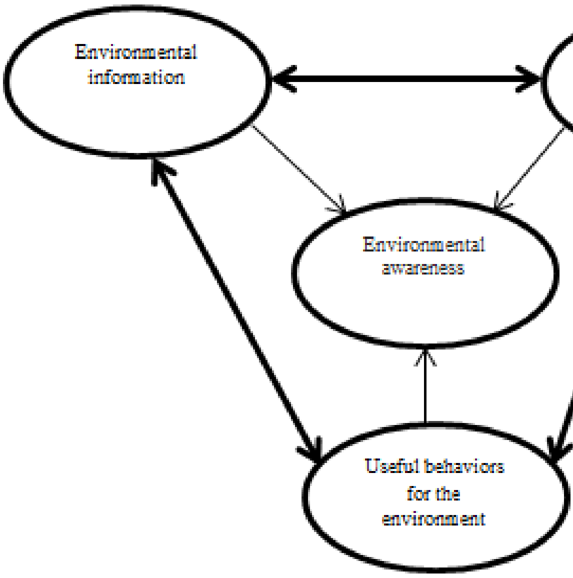
Causes: Consumption society, disposal, wastefulness, not being able to evaluate waste at adequate level, lack of education
Results: Excessive use of natural resources due to excessive use of natural resources due to extreme use of energy and raw materials, destruction of these resources due to depletion of underground and surface waters, inefficiency of soils contaminated with garbage from soil and threats to living creatures living in or on the soil air pollution and epidemics.

As the environmental problems that arise in this way increase day by day, the importance given to the environment and the sustainable environment should be more emphasized today (Kutlay and Şafaklı, 2013). If a sustainable environment can be gained, people will understand that they are a part of the ecosystem, will respect nature and natural environment, will continue to use their environment for themselves and will be able to use alternative sources besides these natural resources (Okur- Berberoğlu and Uygun, 2013). Environmental awareness must also be established in order to ensure that the concept of sustainable environment emerges more, is known and appreciated.

The concept of environmental awareness can be defined as being sensitive to the environment, dealing with the living environment, using and destroying the natural resources in a necessary scale, and reacting and resolving all the problems related to the environment (Kutlay and Şafaklı, 2013). As can be seen, the way to stop this ever-increasing danger is to provide positive attitudes and behaviors towards the environment by giving individuals, that is to say, all the human beings the present and future experiences of the present, free from the thoughts they have and the attitudes they have of the environment (Erten, 2003).

In addition, the environmental consciousness is given in the following diagram, which explains the environmental consciousness concept presented in literature in a different way and explains the factors that affect the formation of the environmental consciousness and the relations between them (Erten, 2005; Erten, 2003, Özdemir and Güler, 2003).

Figure 1. Attitudes, Knowledge and Behaviors of Environmental Consciousness and Environmental Consciousness



The researchers Gülay and Güngör (2015) emphasized that human beings are uneducated under the non-environmentally friendly behaviors that they approach to nature and the environment for their own interests and to use them in their own interests. This problem will be overcome with environmental education and it will be removed from it. Environmental education provides an understanding of all attitudes, concepts, values and positive awareness about people's every environment (Güler, 2009). Another aim of environmental education is to change the scientific developments to be parallel to the world order, and to develop environmental awareness (Özcan, 2016).

Prime Minister of Environment Undersecretary organized by the Turkey Environment Education and Training and the UNESCO National Environmental Strategy and Implementation Plan Seminar "Education for Environment" concept, environmentally sensitive, positive behavioral development and to be permanent, the development of environmental awareness, conservation of all values and the resulting is defined as education that will enable them to actively take part in solutions to problems (Kahyaoğlu, 2011). In short, according to Erten (2015), the concept of environmental education is a tool used to educate individuals who have environmental awareness and show environmentally friendly behaviors. The environmental awareness concept has three main objectives. These goals are: to have environmental knowledge, to show a positive attitude towards the environment and to be useful to the environment. These goals are explained by Erten (2005) as follows:

Environmental Information: Environmental problems, solutions for environmental problems, developments in different ecological areas and information about nature.

Attitudes towards the Environment: Negatives (fears, disturbances, etc.) arising from environmental problems, value judgments and readiness that people have for solving environmental problems and so on. are the attitudes and thoughts that individuals show as positive or negative in the direction of beneficial behaviors for the environment.

Useful Behaviors for the Environment: Behaviors performed by environmentally friendly individuals to protect the environment.

It is important for the society to become conscious for a clean and sustainable environment, to know what a sustainable environment is and to educate it in order to gain environmental awareness (Güneş, Alat and Gözüm, 2013). This education should be given especially to children and children should be trained for the necessary knowledge, attitude and behavior. As people learn about the functioning of the places they live in and the positive and negative effects they have on these areas, they act more sensitively and more aware about the environment (Güler, 2009). Especially in recent years, it has been pointed out that the environmental awareness which is worried about the environment is more worrisome and the environmental awareness which is going to get worse should come to the forefront and that this awareness should be given to the children who are younger with environmental education (Gülhan and Yurdatapan, 2014). In other words, it is stated that all these environmental concerns can only be eliminated if the sustainable environmental consciousness is acquired by children and individuals (Artun and Özsevgeç, 2015).

After starting environmental education in primary school age in Turkey are continuing with secondary education after college (Rock, Smart and Sezek, 2009). In addition, education for the environment in our country is maintained both formal and informal. In addition, environmental education in formal education is covered in life science, social science and science courses in the framework of the education programs prepared by the Ministry of National Education (Özcan, 2016).

When we look at researches in environmental education and environmental awareness in the literature, it is seen that most of the researches are based on information and attitudes towards the environment and students are in the fields of primary education, secondary education and higher education. As a result, in some publications in which the information and attitudes towards the environment exist in the groups surveyed, the results of these findings were given as environmental awareness. Based on the fact that these results do not reflect much in the literature given above, it is one of the aims of this research that the conservatory, which is a group which is not taken up to this day, emerges as a need to determine the attitudes, knowledge and behaviors of the 6th, 7th and 8th grade students in secondary school. Whether or not there is a difference in environmental awareness among conservatory secondary school students is also a secondary objective of this study.

Method

In this study, it was aimed to determine the level of environmental consciousness (knowledge, behavior and attitude) of 76 students who were educated in the sixth, seventh and eighth grades of the conservatory middle school level which have no environmental awareness. For this purpose, «environmental awareness scale» was used to measure the environmental consciousness of the students. The scale and the most widely used standardized research in environmental awareness in Turkey and Erten (2005) is a measurement tool developed by five Likert form. The 60-question environmental awareness questionnaire prepared by Erten (2005) was applied to middle school students. The 20 items of this questionnaire are environmental information, the 20 items are the behavior towards the environment and the last 20 items are the items prepared to determine the attitude toward the environment. Statistical analysis of the obtained data was done by SPSS program. The mean values and standard deviations of the data were calculated in order to compare and contrast the differences between attitude, knowledge and behavior and demographic information. Furthermore, in order to determine the contradictions in the materials in different categories, the ones in the attitudes, knowledge and behavior categories were determined and compared according to the mean values. In order to support this, literature analysis and document analysis were conducted. The data obtained are presented in the discussion and findings section from a critical point of view.

Table 1. Demographic information of participants

Gender	**Woman**	56
	Man	20
Branch	**Music**	62
	Ballet	14
Class Level	**6th grade**	22
	7th grade	27
	8th grade	27
Age	**10**	4
	11	9
	12	29
	13	19
	14	12
	15	3

The demographic information of participants in the sample is as indicated in Table 1. In this context, it is seen that the number of female participants (n = 56) is higher than the number of male participants (n = 20). Participants in the music branch (n = 62) were much more than participants in the ballet branch (n = 14). In the class variable, 7th and 8th grade students are in equal number (n = 27) while 6th grade students (n = 22) are fewer. When the age variable is considered, it is seen that the participants are in the 12-year-old group (n = 29) and the least participants are in the 15-year-old group (n = 3

Results and Discussion

General Findings of Students' Environmental Consciousness

Table 2. General average of environmental awareness survey

Questionnaires	**Average**	I totally agree
Attitude	3,620	I agree
Information	3,468	I very little agree
Behaviour	3,188	I don't agree
Attitude-Information-Behaviour	3,425	I never agree

When we look at the environmental conscious dimensions of the students, the level of information about the environment of the students is 3.5, the level of the attitudes is 3,6 and the environment friendly behavior is 3.2. Average environmental awareness average scores are 3.4. These results are in line with the ever secondary school students study conducted in Turkey. In other words, when the answers given by the students to the environmental awareness scale were evaluated in terms of dimensions, it was determined that attitudes, knowledge and behavior dimensions are little in the range of participation and participation. In short, it is observed that the environmental awareness level of the conservator students does not differ from the general secondary school student profile (Erten, 2002).

Table 3. General average of the branch variable of the environmental awareness questionnaire

Questionnaires	**Branch**	**N**	**Average**	**Standard Deviation**
Attitude (1-20)	Music	62	3,615	0,362
	Ballet	14	3,639	0,285
Information (1-20)	Music	62	3,506	0,388
	Ballet	14	3,304	0,519
Behaviour (1-20)	Music	62	3,199	0,417
	Ballet	14	3,139	0,499

According to the questionnaire branch variable, it was determined that there was no significant difference between the music and ballet students when the branch change between 62 music and 14 ballet students was examined. However, it has been observed that music and ballet students have an average of 3.5 in the attitude category and music students in the information category have an average of 3.5 in the attitude category and they have a closer tendency to participate.

Table 4. General averages of the age variable of the environmental awareness questionnaire

Questionnaires	Age	N	Average	Standard Deviation
Attitude (1-20)	10	4	3,750	0,342
	11	9	3,461	0,631
	12	29	3,617	0,242
	13	19	3,695	0,290
	14	12	3,583	0,415
	15	3	3,617	0,153
Information (1-20)	10	4	3,550	0,404
	11	9	3,300	0,557
	12	29	3,526	0,384
	13	19	3,463	0,461
	14	12	3,438	0,395
	15	3	3,467	0,236
Behaviour (1-20)	10	4	3,238	0,287
	11	9	2,850	0,504
	12	29	3,286	0,446
	13	19	3,274	0,410
	14	12	3,138	0,304
	15	3	2,850	0,236

When the questionnaires were analyzed by age variable, it was determined that the students in the group of 10 years had a higher average in the attitude (3.8) and knowledge (3.6) questionnaires. In the Behavioral Survey, it was determined that the averages of the students in the 10-year-old group (3,6) were higher than the students in the other age group. It was also found that the answers to the information categorized by the students in the 11-year group (2,9) and the students in the 15-year group (2,9) had a lower average than the students in the other age group.

Table 5. General average of the class level variable of the environmental awareness questionnaire

Questionnaires	Class Level	N	Average	Standard Deviation
Attitude (1-20)	6	22	3,643	0,459
	7	27	3,556	0,314
	8	27	3,665	0,268
Information (1-20)	6	22	3,459	0,458
	7	27	3,483	0,497
	8	27	3,461	0,298
Behaviour (1-20)	6	22	3,007	0,424
	7	27	3,330	0,451
	8	27	3,194	0,370

When the questionnaires were analyzed according to the class variable, it was determined that the attitude (3.7) was higher than that of the other classes in the 6th and 8th grade in the questionnaire and the 7th grade in the behavior questionnaire (3.3). In the information survey it was determined that all classes had the same average (3,5). However, there is no significant difference between age groups in general. It has also been found that attitudes and information categories are closer to the tendency of all class-level students to participate.

Findings of Students' Attitudes Categorized by Answers

Table 6. Averages of the responses given to the items in the attitude category

Items	Average
E1	4,76
E2	1,89
E3	3,79
E4	3,89
E5	4,8
E6	4,33
E7	4,3
E8	4,16
E9	2,97
E10	1,55
E11	4,42
E12	4,3
E13	3,79
E14	4,25
E15	4,16
E16	3,47
E17	4,28
E18	1,97
E19	3,08
E20	2,21

When we look at the average of the items in the attitude category, the highest average belongs to E5 (I think that many human beings in the ending animal in the end are mistaken to get out of the way) and the lowest average belongs to E10 (I do not intend to do anything to keep the seas, lakes and rivers clean). In other words, students are eager to do so in order to keep the seas, lakes and rivers clean.

Differences Between Attitude and Behavior Categories

- Although I would like to learn the information about how to keep the sea, lakes and rivers clean, the average of the answers given by the students is only (2.38) in spite of how often you participate in the trainings for the protection of the environment despite the average of the students (4,16). They indicate that they have the information they need to keep the environment clean, but that they do not participate in the training activities necessary to turn this information into behavior.

This is supported by Erten (2003) 's pre - school teachers. Pre-school teachers want to learn about conservation students as well as how to keep the sea, lakes and rivers clean. But they do not participate in educational activities to protect the environment.

- Although pupils identify that politicians are not guilty in the creation of disasters (2,97), they want to do something to keep the oceans, lakes and rivers clean (1,55), and they want to do something to prevent further deterioration of nature (4,42) they responded negatively to the question whether you wrote a newspaper or a journalist, a politician, or any of its officials (1,58). In this case, although the responses to students' attitudes towards environmental protection and information questions are positive and high, the responses to behavior are low.

- Most of the students stated that they did not have much conversation with their friends about environmental pollution (2,33) although they stated that they wanted to do something to prevent more deterioration of nature (4,42). It was determined that the students wanted to be involved in the pollution of the environment but they were not able to talk about it with their friends.

- Even though an individual believes that even an individual will make enormous contributions to the protection of the environment (4,3), they have stated that almost all of the members of the group of friends have bought box drinks (3,46). This meant that the students had to see that all the individuals had to do something with regard to the protection of the environment and that they had seen mistakes made about their behavior.

Findings of Students' Information Categorized Answers

Table 7. Averages of responses to the items in the information category

Items	Average
V1	2,18
V2	4,66
V3	3,47
V4	3,93
V5	1,46
V6	4,39
V7	3,32
V8	3,64
V9	4,28
V10	4,38
V11	3,58
V12	4,17
V13	3,51
V14	4,34
V15	4,04
V16	4,01
V17	2,57
V18	2,83
V19	2,54
V20	2,05

When we look at the average of the items in the information category, it is seen that the highest average belongs to V2 (many rivers and seas are inhabitable and deteriorated due to excessive pollution) and the lowest average belongs to V5 (Exhaust gas harms trees but does not harm people)

Differences Between Knowledge and Behavior Categories

- Students are more likely to take our beverages in returnable bottles instead of in single-use boxes (4,28), and throw broken bottles and bottled bottles into glass pigeons (4,04), despite they do not use the used bottles to throw them into the bottles (2,97). It is understood that the students did not throw the bottles into the bottles and did not make any contribution to the utilization of the recycling feature.

This finding is consistent with Erten's (2002) study with 6th, 7th and 8th grade students, and conservatory students do not perform enough to throw bottles into the bottle.

- Students, glass waste in the municipalities in Turkey, plastics, paper and even though they know they are doing the distinction as the metal (4.34) homes in an unused paper separation and collected place in the notice or forwarding shaped substance (2.89) gave a negative answer. That is to say, although students know that municipalities are separating solid wastes, students have stated that they do not show too much of the behavior of delivering waste papers in their houses to their collection sites.

- Although students have stated that drinking beverages are more beneficial for preserving the environment (4,28) than buying once-in-one bottles, they do not use too many baskets, nets, or long-used market pouches (2,75) to go shopping.

Findings of Students' Behavioral Categorization Answers

Table 8. Averages of the answers given to the items in the behavior category

Items	Average
W1	2,84
W2	3,47
W3	2,89
W4	3,46
W5	2,54
W6	3,46
W7	1,71
W8	2,97
W9	3,59
W10	3,91
W11	4,17
W12	4,09
W13	4,29
W14	2,33
W15	2,5
W16	2,75
W17	4,61
W18	4,21
W19	2,38
W20	1,58

When you look at the average of the items in the behavior category, you can see that the highest average belongs to W17 (I check whether the fennel is closed well after finishing work) and the lowest average is W20 (Do you write to a newspaper or journalist, politician or authorized person to prevent environmental pollution?).

Differences Between Attitudes, Knowledge and Behavior Categories

- I am very sad to see the used papers that the children have replied in the other trashes (3,79) and it is very important in terms of preserving the environment to take the recycled paper while taking the paper (4,38), showing that they are conscious of this issue, (2.89),as opposed to this situation. This indicates that knowledge and attitudes can’t be transferred to behavior.

Conservatory students argue that taking recycled paper is important for preserving the environment, whereas Erten (2002) states that 6th, 7th and 8th grade students are not paying attention to purchasing recycled paper.

- Students need to know the existence of eco-friendly energy sources such as the sun and wind (4,39), fossil fuels to produce electricity, replace the old model cell phones and computers with new ones (2.5) when there is enough money, (4,01) that the presence of materials such as clothing closets would cause energy wastage (3, 79), but they were afraid of the depletion of fossil fuel resources in the near future. This indicates that students have accurate information about fossil fuels and that they do not show new model phone and computer purchasing behaviors in order not to increase carbon dioxide emissions but that their attitudes towards fossil fuels are positive for fossil fuels and they are afraid of depletion of fossil fuels.

Conclusion

In the direction of the data obtained from the questionnaires, it is not enough for the individuals to have a high level of environmental attitudes and environment attitudes in the emergence and development of environmental awareness and to show beneficial behavior towards the environment. In other words, it is not right to make generalizations about the attitudes towards environmental awareness and the fact that individuals with high environmental awareness show environmentally friendly behaviors.

As a result of the research findings, it was determined that conservative secondary school students had a higher level of environmental attitude and environmental knowledge than the beneficial behaviors they showed for the environment. Also, attitudes towards the environment and the high level of environmental knowledge are not enough for the students to show beneficial behavior to the environment. In short, it has been determined that attitudes and knowledge levels towards the protection of the environment are not very effective in the positive behavioral development of the students. Conservatory students have not turned their knowledge and attitudes towards their surroundings into behavior in their own lives.

Recommendations

Based on the results obtained, the following suggestions are made:

- Environmental education for the emergence and development of environmental awareness in students can be given in the classroom environment as well as in the natural environment. Thus, students will receive environmental education in which cognitive, emotional and psychomotor learning will be realized and will have environmental awareness in this way.
- Environmental education should start to be given at a young age. Because there is a lot of research on the attitudes, knowledge and behaviors that have taken place at a young age affecting the future life of the individual permanently (Erten, 2003).
- Parents and friends (peer) groups should be included in the activities in order to increase the awareness level of the students about the environment and it should be ensured that the sharing of the environmental problems is realized in the students' homes (Karaismailoğlu, 2018).
- Teachers, who have a very important influence in the environmental education they receive, need environmental awareness to be able to train effectively. This may require teachers to take environmental awareness courses both in undergraduate and in-service training.
- Students should be provided with opportunities to follow environmental news to increase their environmental awareness (Karaismailoğlu, 2018).
- In future research on environmental awareness, sustainable education and environmental education in general, researchers will be able to plan more detailed research on knowledge, attitudes and environmentally friendly behaviors, and determine what conditions are required for attitudes and knowledge to turn into environmentally friendly behaviors.
- In order for the students to gain useful behaviors towards the environment, competitions, seminars, participation in activities can be provided.
- Students can use green boxes or eco-friendly event packages. environmental education based on environmental activities should be given to face the problems in order to create environmental awareness and to increase environmental awareness (Candan and Erten, 2015; Karaismailoğlu, 2018).

References

Artun, H. & Özsevgeç, T. (2015). Ortaokul Öğrencilerinin Çevre Eğitimine Yönelik Tutumlarının Değerlendirilmesi. *YYÜ Eğitim Fakültesi Dergisi 12*(1), s.29-50.

Candan, S. & Erten, S. (2015). Pre-Service Teacher Opinions About Eco-Friendly Person Activity Package Developed to Raise Environmental Awareness. *International Electronic Journal of Environmental Education*, *5*(2).

Gülay- Ogelman, H. & Güngör, H. (2015). Türkiye'deki Okul Öncesi Dönem Çevre Eğitimi Çalışmalarının İncelenmesi: 2000-2014 Yılları Arasındaki Tezlerin ve Makalelerin İncelenmesi. *Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 12*(32), s.180-194.

Güler, T. (2009). Ekoloji Temelli Bir Çevre Eğitiminin Öğretmenlerin Çevre Eğitimine Karşı Görüşlerine Etkileri. *Eğitim ve Bilim, 34*(151).

Güneş, T., Alat, K. & Gözüm, A, İ, C,. (2013). Fen Öğretmeni Adaylarına Yönelik Yenilenebilir Enerji Kaynakları Tutum Ölçeği: Geçerlilik ve Güvenirlik Çalışması. *Eğitim Bilimleri Araştırmaları Dergisi, 3*(2).

Gülhan, F. & Yurdatapan, M. (2014). 5e Modeline Uygun Araştırma Sorgulamaya Dayalı Etkinliklerin 5. Sınıf Öğrencilerinin Çevre İle İlgili Tutum Ve Davranışlarına Etkisi. *Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 11*(27), S. 237-258.

Erten, S. (2002). İlköğretimin II. Kademesindeki (6,7 ve 8.sınıflar) Öğrencilerde Çevreye Yararlı Davranışların Araştırılması. V. Ulusal Fen Bilimleri Ve Matematik Eğitimi Kongresi, ODTÜ, Ankara, Türkiye.

Erten, S. (2003). 5. Sınıf Öğrencilerinde "Çöplerin Azaltılması" Bilincinin Kazandırılmasına Yönelik Bir Öğretim Modeli, *H.Ü. Eğitim Fakültesi Dergisi, 25*.

Erten, S. (2005). Okul Öncesi Öğretmen Adaylarında Çevre Dostu Davranışların Araştırılması. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 28*, s.91-100.

Erten, S. (2012). Türk ve Azeri Öğretmen Adaylarında Çevre Bilinci. *Eğitim ve Bilim, 37*(166).

Erten, S., Özdemir, P & Güler, T. (2003). Okul Öncesi Eğitim Kurumlarındaki Öğretmenlerin Çevre Bilinci Düzeylerinin Ve Bu Okullardaki Çevre Eğitiminin Durumunun Belirlenmesi. OMEP, Dünya Konsey Toplantısı ve Konferansı, Kuşadası, Türkiye.

Ersoy- Quadır, S. (2015). Kamu Çalışanlarının Çevre Bilinçleri Üzerine Bir İnceleme (Selçuk Üniversitesi, Konya Örneği). *Selçuk Üniversitesi Sosyal Bilimler Meslek Yüksekokulu Dergisi, 17*(1), s.107-129.

Kahyaoğlu, M. (2011). Çevre Konularıyla İlgili Kitap Okumaya Yönelik Tutum Ölçeği Geliştirme Çalışması. *İlköğretim Online, 10*(3), 1056-1065.

Karaismailoğlu, E. S. (2018). Öğretmenlerin Çevre Bilici Düzeyinin Belirlenmesi- Ankara Etimesgut Örneği. Yüksek Lisans Tezi. Ankara.

Kaya, E., Akıllı, M. & Sezek, F. (2009). Lise Öğrencilerinin Çevreye Karşı Tutumlarının Cinsiyet Açısından İncelenmesi. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, 9*(18), s.43-54.

Kutlay, K. & Şafaklı, O.V. (2013). KKTC Karpaz Bölgesi Çevre Sorunları ve Bilinci Üzerine Bir Çalışma. *Laü Sosyal Bilimler Dergisi, 4*(2).

Okur- Berberoğlu, E. & Uygun, S. (2013). Tübitak 4004 Projelerinin Sürdürülebilir Kalkınma İçin Çevre Eğitimi Kapsamında Değerlendirilmesi.

Özcan, E. (2016). İlkokul Öğrencilerinin Çevreye Yönelik Tutumlarının İncelenmesi. *Pamukkale Üniversitesi*, *Yayımlanmış Yüksek Lisans Tezi.*

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 193-199

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Descriptive Analysis of Diagrammatic Representations of Turkish Middle School Science Textbooks

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Abstract: The aim of this study is to examine diagrammatic representations in middle school science textbooks based on diagrammatic typology to find out a general picture of how diagrammatic representations used in science textbooks over fifteen years. Textbooks are an important role in education as primary teaching and learning source. The sample consist of total number of twelve 6th, 7th and 8th grade science textbooks from 2002 to 2017 in Turkey. Textbooks analyzed based on content analysis method. Systematic coding and categorizing of diagrams, photos, charts, graphs, drawings and tables analyzed based on Hegarty, Carpenter and Just‟s (1991) typology and Khine and Liu‟s coding scheme. Diagrams coded as Graphical Types including iconic, schematic, charts and graphs, and augmented reality; Gender Representation, Indexing, Captioning and Quality. Finding of the study showed that schematic representations is preferred compared to iconic and charts and graphs. Male representation is highly dominant in all grades of middle school science textbooks.

Keywords: Visual representation, Textbooks, Science education

Introduction

This study aims to find out the distribution pattern of various diagrammatic types being used in the science textbooks published since 2002. Textbooks are important teaching sources which teachers and students have benefit for obtaining knowledge during schooling years (Liu and Khine, 2016; King, 2009, Misulis, 1997, Irez, 2008, Groves, 1995, Devetak and Vogrinc, 2013). Pinto and Ametller (2002) discussed that students assess visual images a part of written text rather than independent way from text. According to Digisi and Willett (1995), textbooks as an important tool for students' science achievement as well as have an effect of students‟ cognitive and metacognitive skills (Liu and Khine, 2016). 90% of the students learn science from the textbooks (Peacock and Gates, 2000)

Devetak and Vogrinc (2013) suggested that three elements of textbooks are important: general structure, textual material and visual material. General structure includes general information of the textbooks such as number of pages, chapters, length of the chapters etc. Visual aspect of textbooks become even more important in science learning and teaching because according to Kesidou and Roseman (2002) inaccuracies in textbook illustration cause students"‟ misconceptions and visual representations helps students to develop expert view of conceptual understanding of the subject (Devetak and Vogrinc, 2013)

Form of diagrams, illustrations, drawings, photographs, formulas, graphs and tables are an important part of today‟s science textbooks (Lee, 2010; Devetak and Vogrinc, 2013). Researcher have been work on visual representation of textbooks. Mainly they research focused on what representations are?, what are they for, how many different types are they, in how many different ways can they be used and what difference does it make whether they are in the mind or on paper?

Half of the page space in science textbooks is dedicated to visual images (Lee, 2010). 85% of those visual images are not related to content (not indexed) (Mayer, 1993). Most of the pictures are iconic (Lee, 2010).

According to Pozzer and Roth (2003) textbook authors preferred to use iconic representations especially to photographs (over 70% of all representations in sample of their study). European and non-European countries textbooks have more texts than images (Liu and Khine, 2016). Iconicity is used high level in modern-day science textbooks (Hegarty, Carpenter, & Just, 1990). According to Kesidou and Roseman (2002) inaccuracies in textbook illustration cause students"' misconceptions (Devetak and Vogrinc, 2013).

Graphical Analysis Protocol (GAP) proposed by Slough and McTigue (2013) is based on four principles: (1) graphics should be considered by form and function, (2) graphics should help a viewer build a mental model of a system, (3) graphics and texts should be physically integrated, (4) graphics and texts should be semantically integrated and discuss three research articles utilizing the GAP instrument for unique science textbooks.

How to Assess Visual Representations

According to Hegarty et al. (1991) diagrams in textbooks are not used in science textbooks randomly by textbook authors instead there should be rules to facilitate students" conceptual change. Liu and Khine (2016) offered modelling which includes three categories:

1. Analogical models: Principle of analogical reasoning is founded in constructivism. According to analogical reasoning students construct his/her cognitive map with associating his/her new information with previous knowledge (Liu and Khine, 2016). Analogical models are symbols, equations and graphs.
2. Diagrams and maps
3. Simulations

Grosslight et al. (1991) suggested three levels of modelling levels. In level 1, students believe that there is a 1:1 correspondence between models and reality (models are toys or small incomplete copies of actual objects); models should be „right", and they do not search the model"s form for ideas or purposes. In level 2, where models remain real world objects or events rather than representations of ideas; and the model"s main purpose is communication rather than for exploring ideas. Level 3 includes models should be multiple; are thinking tools; and can be purposefully manipulated by the modeler to suit his/her epistemological needs (Harrison and Treagust, 2000).

Method

Content analysis technique is used to analyze visual representations in textbooks.

Sample

Sample consist of 12 science textbooks published in Turkey from 2002 to 2017. Textbooks for 6-7 and 8 grades. All textbooks were approved by the Ministry of National Education (MoNE). A sample of 6247 visual images (2078 visual image from 6th grade, 2497 visual image from 7th grade and 1697 visual image from 8th grade) in total 2581 pages were collected from the textbooks.

List of the science textbooks are shown below:

- Güngör, B., Dökme, İ., Ülker, S., Yıldıran, F.N., Aydınlı, R. & Baş, B. (2002). İlköğretim Fen Bilgisi 6 Ders Kitabı. Ankara: Milli eğitim Basım Evi.
- Büyük, Ş., Salmaner, V., Baş, Z.B. & Görür, N. (2002). İlköğretim Fen bilgisi 7 Ders Kitabı. Ankara: Milli eğitim Basım Evi.
- Çelik Koyuncu, A., Tiryaki, N., Kavas, B. & Salmaner, V. (2002). İlköğretim Fen bilgisi 8 Ders Kitabı. Ankara: Milli eğitim Basım Evi.
- Taşar, M. F. (Ed.) (2011). İlköğretim Fen ve Teknoloji 6 Ders Kitabı. Ankara: Milli eğitim Basım Evi.
- Boyraz Topaloğlu, Ş. (2012). İlköğretim 7.sınıf Fen ve Teknoloji Ders Kitabı. Ankara: Ekoyay Eğitim yayıncılık.
- Tunç, T., Bakar, E., Başdağ, G., İpek, İ., Bağcı, N., Köroğlu, G. N., Yörük, N. & Keleş, Ö. (2011). İlköğretim Fen ve Teknoloji 8 Ders Kitabı. Ankara: Milli eğitim Basım Evi.
- Öcal, C. (2014). Ortaokul fen bilimleri 6. sınıf. İstanbul: Fenbil Yayıncılık.

- Leblebicioğlu, G. (Ed.). (2014). İlköğretim fen ve teknoloji 7 ders kitabi. MEB.
- Erbaş, K. (2015). İlköğretim Fen ve Teknoloji 8 Ders Kitabı. Ankara: Tuna Matbaacılık Yıldırım Yayınları.
- Gökçe, N. & Işık, N. (2017). Ortaokul Fen Bilimleri 6 Ders Kitabı. Ankara: Tuna Matbaacılık.
- Tuncel, E. (2017). Ortaokul Fen Bilimleri 7 Ders kitabı. Ankara: Tuna Matbaacılık Mevsim Yayıncılık
- Ataş, A. (2017). Ortaokul Fen Bilimleri 8 Ders kitabı. Ankara: Öğün Yayınları
- Urhan, A. (2016). Ortaokul Fen Bilimleri 8 Ders Kitabı. Ankara: Tutku Yayıncılık

Data Analysis

Textbooks analyzed based on diagram coding scheme which was created according to typology proposed by Hegarty, Carpenter & Just (1991) and Khine & Liu (2017). Codes are includes graphical types, gender representation, indexing, captioning, formality of visual image, formulas/equations, function of visual image. A rubric were design based on this coding themes (Table 1)

Table 1. Rubric for coding categories

	Graphical types				Gender		Indexing		Captioning		Formality of visual images			Formulas/ equations		Function of visual images			
Page number	Iconic	schematic	Charts/ graphs	Augmented reality	female	male	None	indexed	No caption	captioned	Conventional	Hybrid	Realistic	Verbal	Visual	Classificational	Analytical	Narrative	Metaphorical

Graphical Types

1. Iconic representations are “directly resemble the objects being depicted” (Lee, 2010, p. 5), represent objects concretely and spatially; they commonly take photographs and line drawings of objects, hand-drawing or a photo of a cat (Hegarty, Carpenter & Just, 1990) (Figure 1)
2. Schematic representations are represent abstract concepts and use conventions such as concise notations to describe key relationships or interactions, a chart showing the human digestive system, magnetic fields, Venn diagram (Hegarty, Carpenter & Just, 1990). Diagrams of light rays interacting with matter comprise one of the numerous types of schematic and abstract representations in optical sciences, circuit diagrams, cladograms, and free-body force diagrams (Figure 2).
3. Charts & graphs includes quantitative and numerical data (Hegarty, Carpenter & Just, 1990). Graphic objects and elements that are conventionally used to communicate scientific ideas (Figure 3)
4. Augmented Reality (AR) which images is designed and produced by multimedia technology (Azuma, 1997; Liu and Khine, 2016) (Figure 4)

Figure 1. Iconic image of corns taken from 6th grade textbook (MoNE, 2002, p. 40).

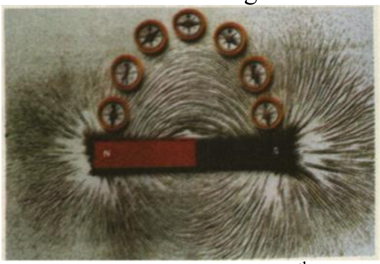

Figure 2. Schematic image of magnetic fields taken from 6th grade textbook (MoNe, 2002, p. 148)

Tür	2n
Kedi	2 x 19
Köpek	2 x 39
Deniz yıldızı	2 x 47
At	2 x 32
İnsan	2 x 23
Moli balığı	2 x 23
Soğan	2 x 8
Güvercin	2 x 8

Figure 3. Charts and graphs taken from 8th grade textbook (MoNe, 2002, p. 112)

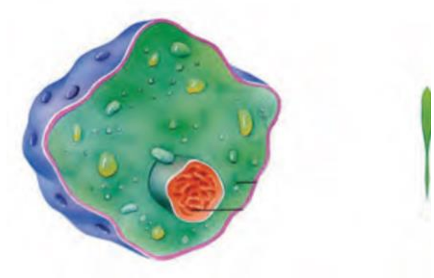

Figure 4. Augmented reality of animal cell taken from 7th grade textbooks (MoNe, 2017, p.16)

Indexing

Indexing analyze based on two categories. First one includes photograph or drawing is not mentioned in the text. The second one includes indexing which has three conditions (1) photograph or drawing is not mentioned in the text, (2) a good textbooks should include relationship between textual and visual material and (3) in a textbook, if visual element is discussed in text than this textbook considered as a good course material (Devetak and Vogrinc, 2013).

Captioning

Captioning analyzed based on no caption and captioned categories. No caption category includes no title or description under graph or drawing. Captioned one has a title or description which is written under graph or drawing.

Formality of Visual Images

Formality of visual images analyzed in three categories.

1. Realistic image: Reality according to human optical perspective including photographs and drawings (Dimopoulos, Koulaidis & Sklaveniti, 2003; Devetak and Vogrinc, 2013).
2. Conventional image: graphs, maps, flowcharts, molecular structures and diagrams (Dimopoulos, Koulaidis & Sklaveniti, 2003; Devetak and Vogrinc, 2013).

3. Hybrids: include both realistic and conventional images (Dimopoulos, Koulaidis & Sklaveniti, 2003; Devetak and Vogrinc, 2013).

Function of Visual Images

1. Classificational: exhibit relationships between people, places and things (Dimopoulos, Koulaidis & Sklaveniti, 2003).
2. Analytical: focus on relationships in object from part to whole structure (Dimopoulos, Koulaidis & Sklaveniti, 2003). .
3. Narrative: in this kind of image include a vector either explicitly or imaginarily (Dimopoulos, Koulaidis & Sklaveniti, 2003). Example: experimental procedure, nitrogen cycle in nature etc.
4. Metaphorical: these images it‟s not symbolize meanings and values and they mostly associated with the cultural symbols (Dimopoulos, Koulaidis & Sklaveniti, 2003).

Results

The twelve science textbooks were analyze based on total number of representation and average number of representations per page (Table 2). 7th grade textbooks which is published in 2002 had more visual representations than others. 8th grade textbooks which is published in 2017 had less number of representations.

Table 2. Number of representations in textbooks

No	Grade	Year	# of Pages sampled	Total # of representations	Average # of representations per page
1	6th	2002	171	414	2.42
2	6th	2011	258	735	2.84
3	6th	2014	176	309	1.75
4	6th	2017	226	620	2.74
5	7th	2002	159	507	3.18
6	7th	2012	239	658	2.75
7	7th	2014	243	547	2.25
8	7th	2017	254	760	2.99
9	8th	2002	156	448	2.87
10	8th	2011	259	527	2.03
11	8th	2015	258	439	1.70
12	8th	2017	182	283	1.55

Analysis of 6th grade‟s textbooks based on graphical type showed that iconic diagrams is good sources to teach science concepts and increase conceptual learning. 2011 textbooks is better because it has more iconic images. Analysis of 7th grade textbooks based on graphical type showed that schematic diagrams are generally used in upper levels. We can see that 2017 textbook has more schematic images. In 8th grade textbooks, 2002 textbook had more schematic representations and 2017 textbook had lowest representation of graphical type among other textbooks.

6th grades textbooks analysis based on gender representation showed that 2011 and 2017 textbooks had more female representation than male representation. In 7th grade textbooks 2017 had more female representation than others. Among 8th grade textbooks, 2011 one has equal representation of female and male genders. However 2015 had lowest representation in both gender.

Analysis of 6th grade‟s textbooks based on indexing showed that overall all textbooks‟ had visual representation with indexing. 7th grade‟s textbooks analysis based on indexing showed that 2017 textbook had more visual image without indexing than others. In 8th grade textbooks, 2015 textbook had more none-indexing visual images while 2017 textbook has less number of none-indexing visual images.

Analysis of 6th grade‟s textbooks based on captioning showed that 2017 textbooks have a better representation in terms of captioning. 7th grade‟s textbooks analysis based on captioning showed that 2014 and 2017 textbooks

had more visual image without captioning than others while 2012 textbook have a better representation of visual images in terms of captioning. 8th grade textbooks, 2011 and 2015 textbook had more captioned visual images while 2002 textbook have more none captioned visual images.
In terms of formality of captioning conventional images have a strong, hybrid images have moderate and realistic images weak representation of visual images. Analysis of 6th grade‟s textbooks based on formality of visual image showed that 2011 textbook has more realistic images than others while 2017 textbook has more conventional images. 7th grade‟s textbooks analysis based on formality of images showed that 2017 textbook had more conventional images while 2014 textbook has more hybrid images. Also 2012 textbook has more realistic images than others. In 8th grade textbooks, 2002 textbook had more conventional visual images while 2011 textbook has more realistic visual images.

Analysis of 6th grade‟s textbooks based on formulas/equations showed that 2011 textbook has more visual and verbal formulas than others. 2014 textbook doesn‟t include any visual formulas. 7th grade‟s textbooks analysis based on formulas showed that 2012 textbook had more visual formulas and equations while 2014 textbook doesn‟t include any formula or equation at all. In 8th grade textbooks, 2011 textbook had more visual formulas while 2017 textbook have none. Also 2015 textbook has more verbal formulas and equations than others.

In terms of function of visual images classificational and analytical images emphasize strong visual images and narrative and metaphorical images emphasize weak visual images. Analysis of 6th grade‟s textbooks based on function of visual images showed that 2002, 2011, 2014 and 2017 textbooks have more analytical representation of visual images than narrative ad metaphorical images. 7th grade‟s textbooks analysis based on function of visual images all textbooks had good number of analytical images. In 8th grade textbooks, 2002 textbook had more analytical images than others while 2017 textbook have more narrative images.

Conclusion

Results of study showed that there is an increase status of representations in science textbooks. A general decline in the use of abstract representations and a major increase in more concrete and familiar representations (more iconic). An overall decline in formulas over time. Slough vd (2010) and Dimopoulos vd. (2003) research results support our findings. Realistic images use more frequently in textbooks. Female and male representations becoming better compared to old textbooks. Captioning in text is getting common to use. Analytical images is preferred to use from the textbooks authors. So, teachers should a criteria to select best textbooks and effective for their students. Science course materials should be prepared with appropriate visual materials.

References

Azuma, R. (1997). A survey of augmented reality. *In Presence: Tele operators and Virtual Environments 6*(4), 355-385.

Devetak, I. and Vogrine, J. (2013). The criteria for evaluating the quality of the science textbooks. M.S. Khine (Ed.) critical analysis of science textbooks: evaluating instructional effectiveness. Slovenia: Springer.

Digisi, L. L. and Willett, J. B. (1995). What high school biology teachers say about their textbook use: a descriptive study. *Journal of Research in Science Teaching, 32*(2), 123-142.

Dimopoulos, K., Koulaidis, V. and Sklaveniti, S. (2003). Towards an analysis of visual images in school science textbooks and press articles about science and technology. *Research in Science Education, 33*, 189-2016.

Drakopoulou, M., Parkosidis, I., Halkia, K. And Skordoulis, C. (2005). Historical analysis of illustrations of scientific instruments in Greek primary school textbooks. Retrieved from https://www.researchgate.net/profile/Constantine_Skordoulis/publication/242521829_HISTORICAL_ANALYSIS_OF_ILLUSTRATIONS_OF_SCIENTIFIC_INSTRUMENTS_IN_GREEK_PRIMARY_SCHOOL_TEXTBOOKS_1878_-1950/links/0c960528cd2d15ae2b000000/HISTORICAL-ANALYSIS-OF-ILLUSTRATIONS-OF-SCIENTIFIC-INSTRUMENTS-IN-GREEK-PRIMARY-SCHOOL-TEXTBOOKS-1878-1950.pdf July 8, July 8, 2018.

Groves, F. H. (1995). Science vocabulary load of selected secondary textbooks. *School Science and Mathematics, 95*(5), 231-235.

Irez, S. (2008). Nature of science as depicted in Turkish biology textbooks. *Science Education, 93*(3), 422-447.

King, J. H. (2009). An analysis of misconceptions in science textbooks: earth science in England and Wales. *International Journal of Science Education, 32*(5), 565-601.

Lee, V. R. (2010). Adaptations and continuities in the use and design of visual representations in US middle school science textbooks. *International Journal of Science Education, 32*(8), 1099-1126.

Liu, Y. & Khine, M. S. (2016). Content analysis of the diagrammatic representations of primary science textbooks. *Eurasia Journal of Mathematics, Science & Technology Education, 12*(8), 1937-1951.

Liu, Y. And Treagust, D.F. (2013). Content analysis of diagrams in secondary school science textbooks. M.S. Khine (Ed.) critical analysis of science textbooks: evaluating instructional effectiveness. Slovenia: Springer

Misulis, K. (1997). Textbook comprehension strategies. *Science scope*, September, 39-42.

Nyachwaya, J. M. And Wood, N. B. (2014). Evaluation of chemical representations in physical chemistry textbooks. *Chemistry Education Research and Practice, 15*, 720-728.

Quasim, S. H. and Pandey, S.S. (2017). Content analysis of diagrammatic representations in upper primary science textbooks. *International Journal of Research, 5*(7), 474-479)

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 200 -208

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Identifying the Factors Influencing the Scientific Competence in Andalusia: A Multilevel Study of the PISA 2012 Results

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Abstract: In this paper we investigate the factors that contribute to the performance of Andalusian students in the scientific competence aspect of the PISA 2012 tests. The variables included refer to the students and schools. Multilevel analysis of the variables reveals that between 9.58% and 14.68% of the differences in the performance are due to characteristics of the schools and that most of the variance is explained by the characteristics of the students. The most significant variables with respect to scientific competence, in a negative sense, are grade repetition, immigrant status and female gender; in a positive sense, they are family and sociocultural background and pre-primary schooling. In the light of these results, we discuss implications for education policy actions. This study shows the multilevel analysis model to be a very useful tool in education studies.

Keywords: Education, PISA, Multilevel regression, Performance, Scientific competence, Andalusia

Introduction

Scientific competence, is defined by the Programme for International Student Assessment (PISA) as "An individual's scientific knowledge and use of that knowledge to identify questions, to acquire new knowledge, to explain scientific phenomena, and to draw evidence-based conclusions about science-related issues, understanding of the characteristic features of science as a form of human knowledge and enquiry, awareness of how science and technology shape our material, intellectual, and cultural environments, and willingness to engage in science-related issues, and with the ideas of science, as a reflective citizen" (OECD, 2006).

Traditional conceptual, procedural and attitudinal contents have been used in most educational reforms carried out since the 1990s. According to Gil and Vilches (2006), the PISA project is a new approach, an attempt to improve the scientific training of the citizens of the 21st century during compulsory schooling, irrespective of whether they continue their scientific formation or not. In other words, the aim is to promote scientific literacy.

PISA tests generate a huge amount of data and results, which may be analysed from different perspectives within the educational community. In this respect, two broad viewpoints have been taken. The first is highly critical of the PISA approach, arguing that the performance of these tests does not take a holistic view of education but, rather, an analytic one, dividing global competence into discrete elements, such as reading competence (evaluated in detail in the 2002 and 2009 editions of the study), mathematical competence (evaluated in the 2004 and 2012 editions) or scientific competence (considered in the 2006 and 2015 editions).

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

Under this analytic approach, each partial competence is defined as a set of capacities that may be evaluated, which simplifies the complex task of conducting an international assessment and provides guarantees for an objective correction of the tests. However, it has been argued that the tests do not take a holistic view of competence and therefore do not really assess it. Other critics claim that the context in which the tests are performed is inappropriate, since acquiring a competence in an academic environment does not assure its mastery and application in non-academic contexts. Traditional pen-and-paper tests are cheap and easy to apply, but their effectiveness is questionable in the sense that they are disconnected from what they seek to evaluate (Yus et al., 2013). The second type of analysis focuses on the usefulness of the data, taking into account that data quality in some cases, such as the information supplied by the heads of education centres or by students' parents, might be significantly improved. The usefulness of these data is influenced by educational policies aimed at enhancing students' performance in education. Performance analyses focus on crucial cultural and socioeconomic factors such as the education level of the parents, the environment, the type of school, the presence of immigrants, grade repetition, the student-teacher ratio and educational resources (Cordero et al., 2013). By means of these analyses, a global evaluation of students' performance can be made, together with one of specific aspects, such as mathematical competence (in PISA 2003) or scientific competence (in PISA 2006) (Calero et al., 2010; Escardíbul, 2008; López et al., 2009). In this analytic process, multilevel logistic models are used, following Choi and Calero (2013) and Cordero et al. (2011) regarding PISA 2009.

The publication of the results of each edition of the PISA study often originates major controversy and intense discussions in the educational environment. The aim of this paper is to present an analysis, using multilevel regression, of the scientific performance of Andalusian students, based on the data collected in the 2012 edition of the PISA project.

Method

Sample and Description of the Variables

The PISA project is a competence evaluation of 15-year-old students, carried out by the OECD every three years. Our study sample is obtained from the 2012 edition of the study, which examined some 510,000 students drawn from a population of 28 million students in 65 countries. In Spain, over 25,000 students from 900 schools located in 14 regions were evaluated. Our analysis focuses on the evaluation of scientific competence according to the data collected for the students in the region of Andalusia.

The PISA project does not evaluate the performance using a single score; rather, the students are scored in each test on a continuous scale. This procedure is based on the item response theory developed by Rasch (1980), according to which the difficulties of each question and the capacities of the student are estimated simultaneously. Under this approach, instead of deriving an average value of the knowledge of each student, five values randomly drawn from the result distribution, called plausible values (PV), are taken (Wu and Adams, 2002). The PV are a representation of the capacities that the student may reasonably be assumed to possess. The multilevel analysis then performed is based on the PV, using the method described in OECD (2003).

The PISA 2012 tests consist of 1076 items that encompass information about variables regarding the school, the household and the socioeconomic context of the student. However, the present study only addresses the variables regarding the student environment and the school environment, which are considered significant in most previous research into education quality. Nevertheless, in addition to the traditional factors, we also consider some innovative aspects, first introduced in PISA 2009, which have received scant attention in previous studies analysing this database. One such question is that of pre-primary schooling, a variable that seems to have made a noticeable impact on the results of the 2009 edition of the PISA study (Cordero et al., 2011). For example, the average difference in performance between the students that attended more than one year of pre-primary courses and those who did not was of 54 points (OECD, 2011).

The variables considered are presented in Table 1. Two types of variables are distinguished: dichotomous (or dummy) and continuous.

Table 1. Variables considered

Student variables		School variables	
Name	*Type*	*Name*	*Type*
Gender	Dummy (0: Male; 1: Female)	Type of school	Dummy (0: Private sch.; 1: Public sch.)
Repeat	Dummy (0: No; 1: Yes, one or more grades)	Does the school "compete" with other surrounding schools?	Dummy (0: No; 1: Yes)
Pre-primary schooling	Dummy (0: No; 1: Yes)	Teacher – students ratio	Continuous
Immigrant	Dummy (0: No; 1: Yes)	Proportion of girls at school	Continuous
Possession of textbooks at home	Dummy (0: No; 1: Yes)	Size of the school	Continuous
Possession of literature at home	Dummy (0: No; 1: Yes)	School location	Dummy (0: Town; 1: City)
Possession of computer at home	Dummy (0: No; 1: Yes)	Is the school's capacity to provide instruction hindered by shortage or inadequacy of science laboratory equipment?	Dummy (0: No; 1: Yes)
Do the language of the test and the language spoken at home match?	Dummy (0: No; 1: Yes)	Responsibility of the school in curriculum design and in evaluation criteria setting	Continuous
Highest educational level of parents	Dummy (0: No; 1: Yes)	Responsibility of the school in resource management	Continuous
Highest parental occupational status	Continuous	Quality of scholar resources	Continuous
Cultural possessions	Continuous		
Index of economic, social and cultural status (ESCS)	Continuous		

The 2012 PISA database is composed of 1,434 entries, with no missing values in the final weight or in the performance estimate of each student. Nevertheless, 80 records contain missing values for some of the variables we have taken as predictors, and these records were removed from the study sample[1]. In Andalusia, the PISA tests were applied in 52 schools (38 were public schools, with 985 students evaluated, and 14 were private schools, with 369 students evaluated). 48.59% of the students were girls. Thus, 1,354 valid entries were analysed.

Method and Results

In this study, the hierarchical organisation of the educational data is modelled using multilevel regression models, in which individuals belonging to the same subgroup are not independent. Most previous empirical studies have used this type of model (Snijders and Bosker, 2012), which take into account that the students take part, or are "nested", in a superior level represented by the schools.

To facilitate analysis, the data from the PISA report are usually separated into two levels: student and school (in this respect, see, for example, Molina et al. (2015), who analysed financial competence using the data presented

[1]Missing values are not always random, and therefore the variances between centres and the variances between students obtained from different models cannot be compared (OECD, 2003).

in the 2012 edition of PISA). On the other hand, Ruíz de Miguel (2009) and Blanco-Blanco et al. (2014) used a three-level model, considering the student, the school and the region as separate levels.

In the present paper, we consider an additive approach to constructing the multilevel models (Dronkers and Robert, 2008). This is usually done using hierarchical systems of regression equations and focusing on the regression coefficients β and the variance components.

First, we analyse the "empty" or "null" model (the one that does not include any independent variable), which provides unbiased estimates of the between-centre and within-centre variances. This model takes the form:

$$Y_{ij} = \beta_{0j} + \varepsilon_{ij} \; ; \quad \varepsilon_{ij} \sim N(0, \sigma_\varepsilon^2) \qquad [1]$$
$$\beta_{0j} = \beta_0 + U_{0j} \; ; \quad U_{0j} \sim N\left(0, \sigma_{u_0}^2\right)$$

The complexity of the null model is progressively increased by adding variables from the two levels. Thus, we first consider an independent variable from level 1, x_{1ij} (the i-th student (level 1) from the j-th school (level 2)).

$$Y_{ij} = \beta_{0j} + \beta_{1j} X_{1ij} + \varepsilon_{ij} \qquad [2]$$
$$\beta_{0j} = \beta_{00} + U_{0j} \; ; \quad U_{0j} \sim N\left(0, \sigma_{u_0}^2\right)$$
$$\beta_{1j} = \beta_{10} + U_{1j} \; ; \quad U_{1j} \sim N\left(0, \sigma_{u_1}^2\right)$$

In equation [2], the subindex j in the regression coefficient indicates that it may vary between schools. If $\beta_{1j} = \beta_1$, the slope is the same for all the schools. The intercept β_{0j} is always considered as a random effect since when it is considered as fixed the multilevel model is reduced to the customary linear regression model.

ε_{ij}: Random effect of level 1.
$\sigma_{u_0}^2$: Between-school variance.
σ_ε^2: Within-school variance.

If there is more than one independent level 1 variable, the model is expressed as follows:

$$Y_{ij} = \beta_{0j} + \beta_{1j} X_{1ij} + \beta_{2j} X_{2ij} + \cdots + \beta_{Qj} X_{Qij} + \varepsilon_{ij} \qquad [3]$$
$$\beta_{0j} = \beta_{00} + U_{0j} \; ; \quad U_{0j} \sim N\left(0, \sigma_{u_0}^2\right)$$
$$\beta_{1j} = \beta_{10} + U_{1j} \; ; \quad U_{1j} \sim N\left(0, \sigma_{u_1}^2\right)$$
$$\cdots\cdots\cdots\cdots\cdots\cdots$$
$$\beta_{Qj} = \beta_{Q0} + U_{Qj} \; ; \quad U_{Qj} \sim N\left(0, \sigma_{u_Q}^2\right)$$

In the level 2 model, each of the coefficients β_{qj} (q = 0, 1, …, Q) becomes a dependent variable of level 2.

$$\beta_{0j} = \gamma_{00} + \gamma_{01} Z_{1j} + \cdots + \gamma_{0L} Z_{Lj} + U_{0j}$$
$$\beta_{1j} = \gamma_{10} + \gamma_{11} Z_{1j} + \cdots + \gamma_{1L} Z_{Lj} + U_{1j}$$
$$\cdots\cdots\cdots\cdots\cdots\cdots$$
$$\beta_{Qj} = \beta_{Q0} + \beta_{Q1} Z_{1j} + \cdots + \beta_{QL} Z_{Lj} + U_{Qj}$$

$\gamma_{QL}\,(l = 0, 1, \dots, L)$: Coefficient of level 2.
Z_{Lj}: Predictor of level 2.
U_{Qj}: Random effect of level 2.

Therefore, the two-level model with Q and L explicative variables associated with the students and the schools, respectively, is expressed as:

$$Y_{ij} = \beta_{0j} + \sum_{q=1}^{Q} \beta_{qj} X_{qij} + \varepsilon_{ij}; \quad \varepsilon_{ij} \sim N(0, \sigma_\varepsilon^2) \qquad [4]$$

$$\beta_{qj} = \gamma_{q0} + \sum_{l=1}^{L} \gamma_{ql} Z_{lj} + U_{qj}; \qquad U_{qj} \sim N(0, T)$$

where T is a matrix whose diagonal is composed of the variances of U_q and the non-diagonal elements are the covariances between them.

The Null Model

As indicated previously, the null model (which does not include any independent variables) is the starting point in the multilevel regression analysis, after which different blocks of independent variables are introduced.

Due to the absence of independent variables in the null model, the intercepts of the schools, β_{0j}, coincide with the performance means of the schools or are close to these means. The variance of U_{0j} is the between-school variance and the variance of ε_{ij} is the within-school variance, and therefore the predicted score for each student will be the mean of the corresponding school. If σ^2_{u0} and σ^2_{ε} are not statistically significant, there is no reason to include independent variables in any of the levels.

The effect of the school factor may be evaluated by comparing the model that includes that effect (Model IA) with the one that does not (Model IB). Table 2 shows the value of the -2LL (-2 log likelihood) statistic associated with each model. The difference between these two values, 14,322.578, is distributed according to a chi-square distribution with 1 degree of freedom. The probability of finding chi-square values equal to or greater than 14,322.578 is less than 0.0005; therefore, we reject the hypothesis that the effect of the school factor is null.

Our estimation of the parameters associated with the fixed and random effects of the null model is presented in Table 2 (the standard errors are shown in brackets).

Table 2. Comparison of models IA and IB

	Fixed part	Random part		
Model I	β_0	σ^2_{ε}	σ^2_{u0}	*-2LL*
A	490.456 (5.048)	6333.747 (248.150)	1054.078 (257.761)	1578.538
B	491.264 (2.333)	7375.586 (283.466)		15901.116

The value of the intercept, β_0, indicates that the average performance of the students is 490.456. Thus, the mean score obtained in science in the PISA 2012 tests is 490.456 and the standard error[2] of 5.048 shows it is statistically significant.

The significance of the within-school variance indicates differences in the performance of students belonging to the same school. Moreover, the significance of the between-school variance highlights the existence of differences in the average performance of these schools. From the significance of these two variances, we conclude that there is an unexplained relationship between the average performance of the students and that of the schools. This justifies our decision to expand the null model by including independent variables from the two levels to explain the residual variance between schools.

The percentage of the total variance attributable to the school is obtained through the intra-class correlation coefficient, ρ, which explains the degree of variability between the schools in comparison with the variability between students of the same school. That is, it reflects how the schools differ regarding the average performance of the students.

$$\rho = \frac{\sigma^2_{u_0}}{\sigma^2_{u_0} + \sigma^2_{\varepsilon}} = \frac{1054.078}{1054.078 + 6333.747} = 0.1426$$

[2]A parameter is considered significant (α= 0.05) when the ratio between the parameter estimate and its standard error is greater than 1.96 (~2).

In this specific case, 14.26% of the difference in the performance of the students is explained by the school effect. In our context, this is a fairly low percentage, from which we deduce that the inequalities in the students' performance arise more from the students' own characteristics than from those of the schools.

Model Expansion

After confirming the significance of the variances obtained, the next step in our analysis of the multilevel models is to explain as much variance as possible in each of the levels. To do so, independent variables from the two levels are included in the model.

In the model including individual characteristics of the students and the characteristics of the schools (see Table 3), the variables Gender, Repeat, Immigrant, Pre-primary schooling, Cultural Possessions, ESCS, Repeat*Immigrant and Repeat*ESCS proved to be significant with coefficient values of -12.515, -65.582, -40.695, 24.763, 8.259, 20.353, 47.391 and -10.955, respectively.

Regarding the individual characteristics of the students, all the variables considered were significant, with grade repetition being the most important factor in all the models. Another important factor, which had a significantly negative effect on the results, was the immigrant status of the student. The coefficient of this variable barely varied when the variables of the family environment were introduced into the model. The remaining variables all had a positive impact on the results. We emphasise the important influence of the interaction between immigrant status and grade repetition.

Focusing on the characteristics of the family environment, the possession of cultural resources and the students' cultural and socioeconomic status positively affected the results. On the other hand, the interaction between the cultural and socioeconomic status and grade repetition had a negative influence on performance.

Comparison of this model (which includes all the predictors of the student and the school levels) with the null model (Model I) shows that the between-school variance decreased from 1,054.078 to 433.122 and that the within-school variance fell from 6,333.747 to 4,611.280. The joint effect of the student-related and the school-related variables very largely explains the between-class and within-class differences observed in the null model, as evidenced by the significant decrease in the residual variance.

Table 3. Final model with variables of the student level and the school level

Fixed part			
Variables	β_{0j}	β_{qj}	*-2LL*
Gender	496.447 (17.171)	-12.515 (3.816)	14865.418
Repeat		-65.582 (4.788)	
Immigrant		-40.695 (14.026)	
Pre-primary schooling		24.763 (7.703)	
Cultural possessions		8.259 (2.327)	
ESCS		20.353 (2.496)	
Repeat * Immigrant		47.391 (22.917)	
Repeat * ESCS		-10.955 (4.551)	
Competition		13.480 (8.435)	
Teacher-students ratio		1.126 (1.089)	
Language of the test and the language spoken at home match		-12.204 (14.170)	

When both groups of predictors were included, the ρ coefficient decreased from 14.26% in Model I to 9.75% in the final model. Thus, the simultaneous effect of the two groups of variables reduced the variability of the performance that is explained by the between-school variance, and therefore the variability of the performance depends to a lesser extent on the differences observed between schools.

Finally, we evaluated the goodness of fit of the proposed model to the PISA 2012 data. To do this, we compared the likelihood ratio coefficient corresponding to the final model (14,865.418) with their counterpart in the null model (15,780.538). Reduction in the likelihood ratio coefficient is, thus, significant, so we can affirm that the proposed model made a significantly greater contribution than the null model.

Conclusion

This paper discusses the results obtained by students in Andalusia (Spain) in the 2012 PISA tests, and seeks to identify the factors that are relevant to the students' scientific performance in these tests. For this purpose, a multilevel regression model was analysed in order to detect the most significant variables, and the sign of this influence.

In the null model, 14.26% of the differences in the students' performance is explained by the school effect. This value is fairly low, which means that the inequalities detected in the students' results can be attributed more to their own characteristics than to those of their schools. These results are similar to those reported in previous studies, both for Andalusia and for other regions in Spain (Cordero et al., 2010). Nevertheless, these findings, with an average inequality attributable to Spanish schools of 14.7% (with a maximum of 20%) are strikingly different from those obtained in other countries; for example, in the Netherlands and Australia, this value is close to 50%.

The most significant variable was found to be grade repetition, with a strong negative effect (-65.582). This finding means that policymakers should devote considerable thought to grade repetition strategies and relevant factors.

Immigrant status and the interaction Repeat*ESCS also had negative effects on scientific performance (- 40.695 and -11.045). On the other hand, male gender, pre-primary schooling and the variables Cultural Possessions, ESCS and Repeat*Immigrant, all increased the students' scientific performance, by 12.515, 24.763, 8.259, 20.353 and 47.391 points, respectively.

The results obtained with respect to these variables should be taken into consideration in the formulation of education policies. Regarding immigrant students, two groups should be distinguished, in order to assess levels of integration: those who were born abroad (first generation) and their children (second generation). At present, these disaggregated data are not available, but should be obtained, together with knowledge of the students' native language, as both of these questions are fundamental to the acquisition of academic competence. What measures should schools take regarding immigrant students? National and international experience suggests that various alternatives may be considered (Choi and Calero, 2013).

For over 20 years, gender studies in the educational context have shown that girls and boys differ in their perception of science and mathematics. Thus, girls consider these subjects more difficult and believe that studying science is more specific to boys. Differences in attitudes towards science have also been analysed in children of different ages and among different ethnic groups and different countries (Gail et al., 2000; Ford et al., 2006; Buck et al., 2008; Vázquez and Manassero, 2010; Riegle-Crumb et al., 2011). The coefficients of the negative results of girls are not very large. Nevertheless, eradicating this gender bias from scientific performance continues to pose a major challenge.

School attendance rates among children aged 3-5 years are very high and the importance of this early schooling for future academic performance has been highlighted in several empirical studies (Leuven et al., 2010). Accordingly, the more pre-primary places that can be provided, the better. Nevertheless, studies should also be undertaken to consider whether the effect of early schooling on children's later scientific performance is related to the scientific education prompted by their parents (Ho, 2010).

The ESCS has a significant and positive effect on the results, raising scientific performance by 20.353 points. This index is considered one of the most important indicators of students' academic success or failure. Nevertheless, it should be noted that although there is general agreement that the index should be used, a wide range of factors can be included in its estimation (with family income and the education level of the parents being the most commonly employed).

With respect to measuring the parameters in a multilevel model, it is important to note the simultaneous effect of all the predictors included in our model on academic performance. After introducing the independent variable related to socioeconomic status, the variables Gender, Repeat, Immigrant and Pre-primary schooling remained significant, but with lower coefficients; for example, the increase in the performance of non-repeater students decreases from 76.111 points to 65.582 points. The negative effect of grade repetition is emphasised in all studies of this question (Choi and Calero, 2013; Calero et al., 2009, 2010).

Palliative measures for under-performance are neither easy nor cheap, requiring more personalised attention for each student and early detection of problems. In a scientific competence context, this would imply a more appropriate specialisation of primary teachers and further training for secondary teachers.

In conclusion, we emphasise the potential offered by multilevel models for developing new lines of research. The methodological contribution of these models to the specific context of school performance research is very important. A recent review (Liou and Hung, 2015) analysed 51 papers, published in eight SSCI journals from 1996 to 2013, which studied PISA or TIMSS data. This review identified multilevel models as a very powerful technique compared to basic descriptive methodologies and correlation approaches. According to these authors, multilevel models are becoming ever more powerful, and may open up valuable areas for future research, in ways impossible by other means. A multilevel regression approach might also be considered for studying and analysing educational centres which present unpredictable behaviour, for instance where the results of scientific, mathematical and reading performance are uncorrelated, which is quite a common situation.

As a final observation, it would be very interesting to extend this analysis to other regions and to consider a three-level model (students, schools and regions). Such comparisons would be very useful for determining the efficiency of regional educational policies (Cordero et al., 2010). In this respect, authorities at the Andalusian Department of Education (Martínez, 2010) have highlighted the need for rigorous studies to put into context the results obtained by Andalusian students in the PISA tests and thus contribute to reviewing, planning and improving educational procedures.

Acknowledgements

This work is partially supported by Consejería de Economía, Innovación, Ciencia y Empleo of the Junta de Andalucía (proyecto P12-HUM-1413).

References

Blanco-Blanco, A., López-Martín, E. and Ruiz de Miguel, C. (2014). Aportaciones de los modelos jerárquico-lineales multivariados a la investigación educativa sobre el rendimiento. Un ejemplo con datos del alumnado español en PISA 2009. Revista de Educación, 365, 122-149. DOI: 10.4438/1988-592X-RE-2014-365-267.

Buck, G.A., Plano-Clarck, V.I., Leslie-Pelecky, D., Lu, Y. and Cerda-Lizarraga, P. (2008). Examining the cognitive processes used by adolescent girls and women scientists in identifying science role models: A feminist approach. Science Education, 92, 688-707. DOI 10.1002/sce.20257.

Calero, J., Choi, A. and Waisgrais, S. (2009). Determinantes del rendimiento educativo del alumnado de origen nacional e inmigrante. Cuadernos Económicos del ICE, 78, 281-311.

Calero, J., Choi, A. and Waisgrais, S. (2010). Determinantes del riesgo de fracaso escolar en España: una aproximación a través de un análisis logístico multinivel aplicado a PISA 2006. Revista de Educación, núm. extraordinario, 225-256.

Choi, A. and Calero, J. (2013). Determinantes del riesgo de fracaso escolar en España en PISA-2009 y propuestas de reforma. Revista de Educación, 362, 562-593.

Cordero, J.M., Crespo, E., and Santín, D. (2010). Factors affecting educational attainment: evidence from Spanish PISA 2006 results. Regional and Sectoral Economic Studies, 10-3, 55-76.

Cordero, J. M., Crespo, E., Pedraja, F. and Santín, D. (2011): Exploring educational efficiency divergences across Spanish regions in pisa 2006. Revista de Economía Aplicada, XIX (57), pp. 117-145.

Cordero, J.M., Crespo, E. and Pedraja, F. (2013). Rendimiento educativo y determinantes según PISA: Una revisión de la literatura en España. Revista de Educación, 362, 273-297 DOI: 10.4438/1988-592X-RE-2011-362-161.

Dronkers, J. and Robert, P. (2008). Differences in scholastic achievement of public, private government-dependent and private independent schools. Educational Policy, 22 (4), 541-577.

Escardíbul, O. (2008). Los determinantes del rendimiento educativo en España. Un análisis a partir de la evaluación de PISA 2006. Investigaciones de Economía de la Educación, 3, 153-162.

Ford, D. J., Brickhouse, N. W., Lottero-Perdue, P. and Kittleson, J. (2006). elementary girls' science reading at home and school. Science Education, 90, 270-288. DOI 10.1002/sce.20139.

Gail, M. J., Howe, A. and Rua, M.J. (2000). Gender differences in students' experiences, interests, and attitudes toward science and scientists. Science Education, 84, 180-192.

Gil, D. and Vilches, A.(2006). ¿Cómo puede contribuir el proyecto PISA a la mejora de la enseñanza de las ciencias (y de otras áreas de conocimiento)? Revista de Educación, extraordinario 2006, 295-311.

Ho, E.S.C. (2010). Family influences on science learning among Hong Kong adolescents: what we learned from PISA. International Journal of Science and Mathematics Education 8, 409-428.

Leuven, E., Lindahl, M., Oosterbeek, H. and Webbink, D. (2010). Expanding Schooling Opportunities for 4-Year-Olds. Economics of Education Review, 29 (3), 319-328.

Liou, P. Y. and Hung, Y. Ch. (2015). Statistical techniques utilized in analyzing PISA and TIMSS data in science education from 1996 to 2013: a methodological review. International Journal of Science and Mathematics Education 13, 1449-1468

López, E., Navarro, E., Ordoñez, X. and Romero, S. J. (2009). Estudio de variables determinantes de eficiencia a través de los modelos jerárquicos lineales en la evaluación PISA 2006: el caso de España. Archivos Analíticos de Políticas Educativas, 17, 1-27.

Martínez López, C. (2010). Andalucía y el informe PISA.

Molina, J.A., Marcenario, O. and Martín, A. (2015). Educación financiera y sistemas educativos en la OECD: Un análisis comparativo con datos PISA 2012. Revista de Educación. 369, 80-103.

OECD (2006). PISA 2006. Marco de la evaluación. Conocimientos y habilidades en Ciencias, Matemáticas y Lectura. Madrid: Santillana; MEC.

OECD (2011). Does participation in pre-primary education translate into better learning outcomes at school? PISA in focus 2011/1.

Rasch, G. (1980). Probabilistic models for some intelligence and attainment tests. Copenhagen, Danish Institute for educational research, expanded edition (1980), University Chicago Press.

Riegle-Crumb, C., Moore, C. and Ramos-Wanda, A. (2011). Who wants to have a career in science or math? Exploring adolescents' future aspirations by gender and race/ethnicity. Science Education, 95, 458-476. DOI 10.1002/sce.20431.

Ruíz de Miguel, C. (2009). Las escuelas eficaces: un estudio multinivel de factores explicativos del rendimiento escolar en el área de matemáticas. Revista de Educación, 348,355-376.

Snijders, T. and Bosker, R. (2012). Multilevel Analysis: An Introduction to Basic and Applied Multilivel Analysis. London: Sage.

Vázquez, A. and Manassero, M.A. (2010). Perfiles actitudinales de la elección de ciencias en secundaria según el sexo y el tipo de educación. Revista Electrónica de Enseñanza de las Ciencias, 9, 1, 242-260.

Wu, M. and Adams, R. J. (2002). Plausible values – why they are important. International Objective Measurement. Workshop, New Orleans.

Yus, R., Fernández, M., Gallardo, M., Barquín, G., Sepúlveda, M. P. and Serván, M.J. (2013). La competencia científica y su evaluación. Análisis de las pruebas estandarizadas de PISA. Revista de Educación, 360, 557-576. DOI: 10.4438/1988-592X-RE-2011-360-127

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 209-216

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

An Examination of the Critical Thinking Skill Levels of the Primary Education Students

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Abstract: What is intended in today's renovated and updated sense of education is not to bring up individuals who merely memorize the information units without questioning, but to bring up enterprising asking, questioning, wondering, problem-solving, and researching individuals, who are equipped with decision-making skills, who may make use of information technologies, and who may think scientifically, creatively, and multi-dimensionally. It is thus intended in this study to determine the levels of critical thinking skill levels of the primary education students, and to examine whether they vary as per the grade levels thereof. Screening design, which intends to describe an existing situation as it is, is therefore used herein. This is a study having been conducted with a total of 173 students from a primary education school in Ankara, which is registered to the Ministry of National Education, 84 of whom are from 6^{th} Grade, 43 of whom are from 7^{th} Grade, and the remaining 46 of whom are from 8^{th} Grade. Cornell Critical Thinking Test-Level X (CCTTLX) was utilized in order to determine the critical thinking levels of the said students. According to the attained findings, critical thinking levels of the students from 6^{th}, 7^{th}, and 8^{th} grades were found to be at medium level. A meaningful difference, which is in favor of the students from the 8^{th} grade, was found between the critical thinking levels of the students from 6^{th} and 8^{th} grades. However, no meaningful difference was found between the critical thinking levels of the students from the 7^{th} grade and those from the 6^{th} and 8^{th} grades. No meaningful difference was found between the critical thinking levels of the said grades also in view of the sub-dimensions of induction, reliability of the observations and sources, deduction, and that of defining the assumptions included within the assessment instrument.
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Keywords: Primary science education, Thinking skills, Critical thinking

Introduction

We live in the age of information and technology. In our daily lives people are subject to an intense flow of information. It is getting difficult to keep track of such an ever-increasing bulk of information. While seeking for an answer to the question of “Which university am I to go?”, deciding on which job we are to take, and under many other similar circumstances we are to make decisions. To make use of a newly launched technological device, to decide whether the news we follow are true or not, to keep track of the events occurring and flowing rapidly around us all require certain skills to come to the fore, and get more developed in the humans. "Thinking" is surely the most important among such skills.

Similar to the adults, children, too, constantly encounter with various problems in their daily lives. They, too, should be able to 'think' in order to solve such problems, and to make and carry out respective decisions. As a

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matter of today's education system, students are subject to numerous assessment and evaluation methods, and undergo important examinations that shape their futures. It is also a necessity for them to possess developed thinking skills in order to achieve the desired success in these examinations.

Development of the thinking skills undoubtedly starts at minor ages, and educational institutions play the most critical role with regard to this issue. Education of thinking, which is deemed as one of the most critical needs of our age, is therefore reflected in the new educational programs. What is intended in today's renovated and updated sense of education is not to bring up individuals who merely memorize the information units without questioning, but to bring up enterprising asking, questioning, wondering, problem-solving, and researching individuals, who are equipped with decision-making skills, who may make use of information technologies, and who may think scientifically, creatively, and multi-dimensionally (Akar, 2007). That is why the classical behaviorist methods have been abandoned in the new programs, and such approaches as constructivism, multiple intelligence, brain-based learning have been adopted in place thereof, and instead of a traditional teacher-centered approach, the aforesaid programs have been designed according to a student-centered approach (MEB (Ministry of National Education),2005). Benefits in parallel of these common objectives have been determined in all programs, and activities have been made up in this direction.

Critical thinking is another one of the most critical skills being required in our age. Having the related literature reviewed, it may be seen that, despite being many in number, the researches carried out in relation with critical thinking were focused mostly on the high-school and university students. There are a negligible number of studies having been carried out on the critical thinking skills of the primary education students. In the recent years, Akar (2007), as matter of the renovated programs, carried out a study on the critical thinking skills of the primary education students, and came across meaningful findings. Accordingly, Cornell Critical Thinking Test-Level X (CCTTLX) was utilized in this research, having been carried out for determining the levels of the critical thinking skill levels of the sixth grade primary education students, educational successes, ages, genders, and academic self-conceptions thereof, and the levels of contribution of the programs applied in the year 2004, and the subject students were found to have answered an average of 29 questions in a test of 71 questions. These outcomes were interpreted as the critical thinking skill levels among the students were "insufficient" However, Demir (2006), in a research he carried out in Ankara by means of an assessment instrument he had developed, found out that, primary education students from 4th and 5th Grades had in general a high level of critical thinking skills. Consequently the situation was deemed as a shortcoming, and it was aimed to carry out studies among primary education students for the purpose of shedding light onto the future researches. In the following sections, information was given with regard to the thinking concept, and to the assessment of the critical thinking.

Thinking

Thinking is generally recognized as a cognitive process, a mental exercise, by which information is obtained. It is defined in numerous forms, such as cognition, perception, discernment, intuition, etc. (Hesapçıoğlu & Bakıroğlu, 1997, p. 53, cit. Ergin, 2006). Although it could not have been clarified due to the varying definitions brought about by the psychologists, such as „reasoning‟ or „forming opinions‟, thinking concept may be defined as the whole of information, abilities, processes, and attitudes as well. According to Paul & Elder (2008), main elements of thinking may be listed as follows;

- Reasoning always has a purpose.
- Reasoning is always an attempt to understand something, explain some questions, and to solve some problems.
- Reasoning is always based on assumptions.
- Reasoning is always made from a certain point of view.
- Reasoning is always based on findings, information, and proofs.
- Reasoning is always molded and expressed by means of concepts and opinions.
- Reasoning always involves implications or interpretations, through which we may reach conclusions, and construe the available data. Reasoning always works up to something, or brings about effects and outcomes.

Critical Thinking

According to the definition of American Philosophical Association/APA (1990), critical thinking skills are the cognitive skills, such as analyzing interpretations, making inferences, explaining and evaluating proofs, thinking in a conceptual, methodological or contextual manner (Akar, 1998). Cüceloğlu (1999: 255-256) defines critical thinking as an active and organized mental process, which enables us to understand ourselves and the events around us by being aware of our own thinking process, considering the thinking processes of others, and applying what we have learned. According to Kazancı (1989), critical thinking is the whole of the processes of attitude, information, and ability, being applied in the argumentation and assessment of a problematic situation in view of scientific, cultural, and social standards and dimensions.

Halpern (2003) sees critical thinking as being purposeful, logical, and goal-oriented. This type of thinking involves problem-solving, inference formulation, calculation of probabilities, and decision-making. Taking the points being common in each and every definition, keywords being mentioned in critical thinking may be put forth as "being active, being goal-oriented, reflection, focusing, observation, interpretation, questioning, judging, inference, use of information, distinguishing the stereotypes, analyzing, assessment, logic, problem-solving, and sympathy" (Akar, 2007).

Ennis (1985) put forth that, critical thinking was not merely a set of abilities, and that individuals had to possess tendencies in critical thinking. Ennis (1985) may list tendencies in critical thinking as follows:
1. Searching for a clear expression of a claim or problem
2. Searching for causes
3. Putting the available information in order, and trying them
4. Making use of, and considering reliable sources
5. Determining the whole situation prior to decision-making
6. Trying the remaining issues for the sake of the main point
7. Keeping the original or basic interest in mind
8. Searching for alternatives
9. Being open-minded
a. Taking others‟ points of view other than his/hers into consideration
b. Delaying or rejecting making judgments when there is no adequate proof and cause at hand
c. Trying to find the causes of obtaining information according to the terms
10. Changing the situation when there are adequate causes and proofs at hand
11. Investigating a subject as thoroughly as permissible
12. Decomposing the parts of a complex whole by an orderly manner
13. Being aware towards his/her own feelings at every stage of his/her works to access information
It is possible to say that many scientists and thinker (McKendree *et al*., 2002; Gomez, 2002; Lewis & Smith, 1993; Halpern, 2003; Paul, 1990; Siegel, 1988; Ennis, 1996; Fung, 2005; Lipman, 1991; Akar, 2007) today mentions of "critical thinking" as one of the most critical skills, which should be possessed by the individuals.

Assessment of Critical Thinking

Various instruments of assessment have been developed by numerous researchers at different times in order to assess the skill of critical thinking. Each and every one of the instruments of assessment differs from each other in terms of;

- features,
- codes of practice,
- aimed grade levels,
- persons,
- scorings, and
- forms of assessment there of (Deniz,2009).

Ennis (2009) has collected these instruments of assessment, having been designed to assess the critical thinking skills under three titles, namely as instruments of assessment assessing multiple dimensions of critical thinking, instruments of assessment assessing only one dimension of critical thinking, and instruments of assessment oriented to certain fields. Many of these instruments of assessment have been collected by Ennis, having studied on the critical thinking skill for long years, and put forth with brief descriptions thereof. One of the critical thinking tests being most widely utilized among the primary and high-school students is the Cornell Critical Thinking Test. Cornell Critical Thinking Test-Level X (CCTTLX) was therefore utilized in this research.
In light of the conducted researches, it was intended to investigate whether the critical thinking skill levels of the primary education students differ in terms of grade level. For this purpose, answers were sought for the following sub-problems:
1. Which level are the following sub-dimensions of the critical thinking skills of the primary education students at in terms of total score

a. Sub-dimension of induction,
b. Sub-dimension of reliability of observations and sources,
c. Sub-dimension of deduction,
d. Sub-dimension of defining the assumptions?

2. Is there any meaningful difference between the critical thinking skill levels of the primary education students from 6th, 7th, and 8th Grades in terms of total score

a. Sub-dimension of induction,
b. Sub-dimension of reliability of observations and sources,
c. Sub-dimension of deduction,
d. Sub-dimension of defining the assumptions?

Method of this research was discussed in the following section.

Method

This research was made for the purpose of determining the critical thinking skill levels of the primary education students, and for the purpose of determining whether their critical thinking skill levels vary as per their grade levels as well. Screening design (Karasar, 1999), which intends to describe an existing situation as it is, is therefore used herein. This is a study having been conducted in the educational year of 2015-2016 with a total of 173 students from a primary education school in Ankara, which is registered to the Ministry of National Education, 84 of whom are from 6th Grade, 43 of whom are from 7th Grade, and the remaining 46 of whom are from 8th Grade.

Data Gathering Tool

Cornell Critical Thinking Test-Level X (CCTTLX) was utilized in the research in order to determine the critical thinking levels of the said students. This instrument of assessment was developed by Ennis & Millman (1985), and adapted to Turkish language by Akar (2007). The multiple (three)-choice test consisting of 71 articles is formed of 4 dimensions.

1. Deducing by way of inductive reasoning: There are 23 questions in this dimension of the test, and the students are expected to deduce correctly with reference to the information (clues) given to them.

2. Deducing by way of deductive reasoning: There are 14 questions in this section. Students are expected to arrive at the correct conclusion with reference to a generalization.

3. Judging the reliability of the observations and sources: There are 24 questions in this section. Students are expected to make accurate observations, and to sort the reliable information out of the information made available to them.

4. Defining (determining) the assumptions within the statements: There are 10 questions in this section. What is expected from the students herein is to sort the stereotypes and pre-assumptions mentioned within the statements.

CEDTDX is applicable from 4th Grade to 14th Grade. Application time for the conduct of the test is for around 50 minutes for the groups of students from secondary education and above. The same is estimated as 64 minutes for the level of primary education. Reliability values of the tool (KR20, KR21 and Sperman-Brown) are seen in between 0.67 and 0.90 in view of the data attained from various researches having been made by the same tool (Ennis, Millman ve Thomko, 2005: 17).

Data Analysis

It was attempted herein to determine whether there was any meaningful difference between the students from 6th, 7th, and 8th Grades in view of the test scores out of those they had earned from Cornell Critical Thinking Test-Level X (CCTTLX). While total scores were taken by way of coding the students" correct answers to the questions in the test by "1", and false ones by "0", average and standard deviation values were calculated therefrom. Single-factor variance analysis (one-way anova) was applied for the unrelated samples in order to determine whether the students‟ critical thinking skills showed any meaningful difference as per the grade levels thereof.

Findings and Interpretation

Analyses relevant to the attained data were applied in this study, which was conducted so as to determine the classical thinking skills of the primary education students. Findings were given successively as per the sub-problems of the research.

Findings about the First Sub-Problem of the Research, and the Interpretation

First sub-problem of the research is "Which level are the sub-dimensions of Induction, Reliability of Observations and Sources, Deduction, and Defining the Assumptions of the critical thinking skills of the primary education students at in terms of total score?" Average and standard deviation values thereof were therefore calculated in order to determine the level of the sub-dimensions and total scores of the students‟ critical thinking skills. The findings obtained are given in Table 1.

Table 1. Students‟ levels in the cornell critical thinking test-level x scale as per the sub-dimensions and total scores thereof

			6th Grade		7th Grade		8th Grade	
Dimensions	N	Number of Articles	X	Ss	X	Ss	X	Ss
1. Induction (Hypothesis testing)	173	23	12,1	3,9	12,4	3,6	13	2,7
2. Reliability of the Observations and Sources	173	24	10,9	3	11,3	3	11,9	2,8
3. Deduction	173	14	7,54	2,3	7,74	2,3	8,3	2,3
4. Definition of the Assumptions	173	10	4	1,5	4,62	1,7	4,47	1,9
CCTTLX Total Test	173	71	34,5	7,8	36,1	5,7	37,7	6,7

Upon reviewing Table 1, in view of the averages of the scores that 6th Grade students obtained from the Cornell Critical Thinking Test-Level X Scale, the average score from the sub-dimension of induction is seen to be 12.05, while the same from the sub-dimension of reliability of the observations and sources is 10.90, from the sub-dimension of deduction is 7.54, and finally their average score from the sub-dimension of definition of the assumptions is seen to be 4.00. Looking at the total scores of the 6th Grade students, the average score was calculated as 34.51, while the standard deviation value was calculated as 7.82.

In view of the averages of the scores that 7th Grade students obtained from the applied instrument of assessment, the average score from the sub-dimension of induction is seen to be 12.44, while the same from the sub-dimension of reliability of the observations and sources is 11.32, from the sub-dimension of deduction is 7.74, and finally their average score from the sub-dimension of definition of the assumptions is seen to be 4.62. Looking at the total scores that the 7th Grade students obtained from the Cornell Critical Thinking Test-Level X Scale, the average thereof was calculated as 36.13, while the standard deviation value was calculated as 5.68.

In view of the averages of the scores that 8th Grade students as per each sub-dimension, the average score from the sub-dimension of induction is seen to be 13.04, while the same from the sub-dimension of reliability of the observations and sources is 11.91, from the sub-dimension of deduction is 8.30, and finally their average score from the sub-dimension of definition of the assumptions is seen to be 4.647. Looking at the total scores that the 8th Grade students obtained from the Cornell Critical Thinking Test-Level X Scale, the average thereof was calculated as 37.73, while the standard deviation value was calculated as 6.69.

In view of the user norms appertained to CCTTLX, primary education students are found to have obtained scores at medium level. According to the meta-analysis conducted by Ennis *et al.* (2005: 12), average of the scores that the students from the levels of 4th, 5th, 6th Grades obtained from CCTTLX is around 35, while the standard deviation level is around 5. The average of the scores that the students from the levels of 7th and 8th Grades is around 37, while the standard deviation level is again around 5. Comparing the analysis results attained from this research with the norm tables, it may be said about the students within the study group that, their critical thinking skill levels are at medium level.

Findings about the Second Sub-Problem of the Research, and the Interpretation

Second sub-problem of the research is "Is there any meaningful difference between the critical thinking skill levels of the primary education students from 6th, 7th, and 8th Grades in terms of total scores of the sub-dimensions of Induction, Reliability of Observations and Sources, Deduction, and Defining the Assumptions?" Averages of the total scores having been obtained by the students of 6th, 7th, and 8th Grades, both from each of the sub-dimensions of the Cornell Critical Thinking Test-Level X Scale, and from the whole of the scale, were checked in order to determine whether there was any meaningful difference between the critical thinking skill levels of the students. Single-factor variance analysis was applied for estimating whether there was any meaningful difference between the average scores as per the grade levels. Findings attained for the total scores of the students" critical thinking skill levels are shown in Table 2.

Table 2. ANOVA results of the total scores obtained by the students from the cornell critical thinking test level x as per the grade levels thereof

Variance Source	Sum of Squares	sd	Mean of Squares	F	p (p<0,05)
Intergroup	317,188	2	158,594	3,189	0,044
Intragroup	8455,02	170	49,735		
Total	8772, 208	172			

Upon reviewing Table 2, a meaningful difference in favor of the 8th Grade students may be seen between the critical thinking levels of the students as per the grade levels thereof ($F(2\text{-}170)= 3,189$, $p<0,05$). In other words, critical thinking levels of the students meaningfully vary depending to the grade levels of the students. Critical thinking skill levels of the 8th Grade students (X= 37,74) were higher than the same skill levels of the 6th Grade students (X= 34,51) according to the results of the Scheffe test, having been conducted so as to find out between which groups do the inter-grade differences exist. However, no meaningful difference was found between the critical thinking levels of the students from the 7th grade (X= 36,14) and those from the 6th and 8th grades. Consequently, in view of the critical thinking skill levels, meaningful difference was found between the 6th and 8th Grade students.

Whether there was any meaningful difference as per the grade level was calculated by means of single-factor variance analysis according to the sub-dimensions of induction, reliability of the observations and sources, deduction, and definition of the assumptions of the Cornell Critical Thinking Test-Level X Scale, having been applied to the critical thinking skill levels of the 6th, 7th, and 8th Grade students. Except the sub-dimension of the definition of the assumptions, an increase may be seen in the scores of all sub-dimensions among students from 6th to 8th Grade. However the results of the conducted analyses reveal that, there is no meaningful difference as per all four sub-dimensions within the scale. It is therefore possible to say that, the skills of induction, reliability of the observations and sources, deduction, and definition of the assumptions do not change depending to the grade levels.

In view of the results attained from the first sub-problem of the research, it was seen that, the critical thinking skill levels were at medium level for 6^{th}, 7^{th}, and 8^{th} Grade students. This is a finding similar to the result of the meta-analysis of the various studies conducted in USA, which were reported by Ennis *et al*. (2005). However, it contradicts with the study, in which Demir (2006) reported that, in the research conducted in the city of Ankara, 4^{th} and 5^{th} Grade students were found to possess high levels of critical thinking skill in general. It is suggested that, the difference between the results of the researches in question may arise from the quality of the instruments of assessment being used therein.

Upon review of the results attained from the second sub-problem of the research in terms of critical thinking skill levels, no meaningful difference was found between the 6^{th} and 7^{th} Grade students, while a meaningful difference in favor of 8^{th} Grade students was found between them and the 8^{th} Grade students. It was further found that, the critical thinking skill levels of the 7^{th} Grade students revealed no meaningful difference between those of the other two grade levels. It is suggested that, the aforesaid meaningful difference between the 6^{th} and 8^{th} Grade students in terms of critical thinking skill levels might have arisen as per the age level. While it is acknowledged that, there is a transition from the concrete operations period to the abstract operations period between these two grade levels, it is an expected outcome for the 8^{th} Grade students to have shown higher levels of critical thinking skills. Besides, it is also suggested that, the teaching program in use is also effective in the development of the critical thinking skill levels, which were found to be increasing at all grade levels in conclusion of the respective researches.

Conclusion and Suggestions

In this section, results of the research are shown on the basis of the findings attained in the third section. There are also suggestions made for the future researches.

Critical thinking skill levels of the students from 6^{th}, 7^{th}, and 8^{th} grades were found to be at medium level. Meanwhile, an increase was seen in the critical thinking skill scores as the grade level increased. Analyzing whether this increase was meaningful, a meaningful difference in favor of 8^{th} grade students was found between the critical thinking skill levels of the 6^{th} and 8^{th} grade students. However, no meaningful difference was found between the critical thinking levels of the students from the 7^{th} grade and those of the students from the 6^{th} and 8^{th} grades. No meaningful difference was found between the critical thinking levels of the said grades also in view of the sub-dimensions of induction, reliability of the observations and sources, deduction, and that of defining the assumptions included within the assessment instrument.

Suggestions

This research was conducted with 173 primary education students from a primary education school. It may be suggested to expand the scope of the research by way of increasing the number of students at different schools in different cities. Researches may be conducted also for determining the factors influencing the critical thinking skills of the students.

While the critical thinking skill levels of the 6^{th}, 7^{th}, and 8^{th} Grade students were found as medium, more gains and activities with regard to the improvement of critical thinking skills may be included within the scope of the teaching programs. Meanwhile, it is further suggested to search for the influence of the lessons included within the teaching programs on the development of the critical thinking skills.

Taking the instruments of assessment being applied both at home and abroad into consideration, it may also be suggested to design and develop new instruments of assessment applicable in Turkey for the assessment of the critical thinking skills. While descriptive and quantitative analysis methods are applied more often in the assessment of the critical thinking skills, not only the qualitative instruments of assessment may be developed, but it may also be suggested to increase the frequency of application of the available instruments of qualitative assessment.

References

AKAR, C. (2007). Ġlköğretim Öğrencilerinde Eleştirel Düşünme Becerileri. Doktora Tezi. Gazi Üniversitesi, Ankara.

APA (1990). Publication manual of the American Psychological Association. Washington, DC.

CÜCEOĞLU, D. (1999). Ġyi Düşün Doğru Karar Ver. (27. Baskı). Ġstanbul: Sistem Yayıncılık

DEMĠR, M. K. (2006). Ġlköğretim Dördüncü ve Beşinci Sınıf Öğrencilerinin Sosyal Bilgiler Derslerinde Eleştirel Düşünme Düzeylerinin Çeşitli Değişkenler Açısından Ġncelenmesi. Doktora Tezi. Gazi Üniversitesi, Ankara.

DENĠZ, E. (2009). Öğretmen Adaylarının Eleştirel Düşünme Beceri Düzeyleri Üzerine Bir Ġnceleme. Yüksek Lisans Tezi. Hacettepe Üniversitesi, Sosyal Bilimler Enstitüsü, Ankara.

ENNĠS, R., H. (2009). An Annotated Lıst Of Crıtıcal Thınkıng Tests. http://www.criticalthinking.net/TestList.html adresinden 13. 01.2013 tarihinde alınmıştır.

ENNĠS, R., H., Millman, J., Thomko, T., N. (2005). Cornell Critical Thinking Tests Level X and Level Z Manual. The Critical Thinking Co. USA.

ENNIS, R. H. (1996). Critical Thinking. Prentice Hall, Upper Saddle River, NJ. USA.

ENNIS, R. H. (1985). A Logical Basis for Measuring Critical Thinking Skills. Educational Leadership. 43.

ERGĠN, H. (2006). Düşünmeyi Öğretmek-I- Çocuklara Düşünmeyi Öğretmek. http://psikologum.gen.tr/modules.php?name=Content&pa=showpage&pid=25&page=1 date of access 12.11.2011

FUNG, I. (2005). Critical Thinking as an Educational Goal: a Fulfilled or Unfulfilled Promise. www.pesa.org.au/html/documents/2005-papers/Paper-14__Irene_Fung.doc date of access 11.12.2011

GOMEZ, F. Jr. (2002). Education As If People Matter: A Call for Critical Thinking and Humanistic Education. http://www.cavehill.uwi.edu/bnccde/belize/conference/papers/gomez.html date of access 13.04.2012

HALPERN, D. F. (2003). Thought & Knowledge: An Introduction to Critical Thinking. (4th ed). Mahwah, New Jersey: Lawrence Erlbaum Associates.

KARASAR, N. (1999). Bilimsel Araştırma Yöntemi. Ankara: Nobel Yayın Dağıtım.

LIPMAN, M. (1991). Thinking in Education. Cambridge, Cambridge University Pres.

McKENDREE, J., SMALL. C., and STENNING, K. (2002). The Role of Representation Teaching and Learning Critical Thinking. Educational Review, Vol.54, No.1.

MEB (2005). Ġlköğretim 1-5. Sınıf Programları, Ankara.

PAUL, R. ve ELDER, L. (2008). Critical Thinking: Concepts and Tools.

PAUL, R., BINKER., A., JENSEN, K., and KREKLAU, H. (1990). Critical Thinking Handbook: A Guide for Remodeling Lesson Plans in Language Arts, Social Studies and Science. Rohnert Park, CA: Foundation for Critical Thinking.

RAPPS, J. (1998). Testing A Theoretical Model of Critical Thinking And Cognitive Development. University of San Diego. (Unpuplished Doctoral Dissertation)

SIEGEL, H. (1988). Educating Reason: Rationality, Critical Thinking, and Education. Routledge, New York.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 217 - 223

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

The Students' and Lecturers' Viewpoint about Efficiency of Mathematics Teaching Style

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Abstract: The technological and industrial advances in any country depend primarily on the interactive academic developments. Indeed the basis for technology has been constructed by science such as mathematics as a top priority. In the present study, along with inspecting five distinctive educational psychology theories, various teaching styles of mathematics were scrutinized. For this purpose, a special questionnaire was developed in which every question includes one of fundamental characteristics of these theories. The participants in this survey were ninety B. Sc. students of mathematical sciences in University of Zabol. According to the statistical analyses, the heuristic problem-solving teaching and speech-based styles were the most interesting and least attractive methods respectively for the survey participant while the speech-based style is the most prevalent teaching style for them.

Keywords: Educational psychology theories, Friedman nonparametric tests, Kolmogorov-Smirnov test, Chi-square test, Kruskal-Wallis test

Introduction

A periodic review of teaching methods is commonplace. The crucial problem in this field is when and how these changes should be made. Although the answer to this question is a separate issue, it seems that conducting international standard tests and the comparison of the statistical results with global measures can be very supportive about the necessity or the need for such changes. In the 1999 TIMSS test performed for the eighth grade students in Singapore, 94% of Singaporean students taking the test scored above the global average. These scores were 82%, 83%, and 80% for students in South Korea, Japan and Hong Kong respectively. While, the levels of the balance were 48%, 45% and 36% for the United Kingdom, the United States and Spain respectively. According to the report, the TIMSS balance of the students in the Islamic Republic of Iran at the same educational grade was less than 25% (Mullis et al., 2000). This international standard test shows a significant difference in student's educational level. In the more recently timeframe, according to the data for 2011, the Islamic Republic of Iran rate equals to 25% similar to students' results in Qatar, Bahrain, Jordan and Palestine. While South Korea, Singapore, Hong Kong and Japan had the highest levels. The necessity of the review in the educational methods can be clarified by considering these facts. It is necessary to adopt a teaching methodology that meets both the sociological and academic community requirements.

The main learning theories can be divided into six general philosophies, each of which naturally has its own perspective on teaching mathematics. First of all, the theoretical foundations of some of these philosophies were reviewed. Then, the thoughts of the founders of these philosophies are discussed. Eight different methods will be introduced based on these philosophies.

The first method of teaching mathematics is the practice-oriented approach. This method is influenced by the philosophy of behaviorism or functionalism. One of the founders of this philosophy is Thorndike. From Thorndike viewpoint, a class is arranged with clear and predetermined goals (Schultz, 2014). Learning at Thorndike's philosophy goes from simple to complex issues. The student is encouraged if the answer is correct and the wrong answer should be corrected quickly to prevent it from being repeated. Thorndike followers prefer individual and private tutoring over lecture-style education (Sha'bani, 2008). The most important features of this teaching style are the pointless memorization of concepts and algorithms, dividing all the exercises into a series of smaller steps, and finally solving a large number of exercises and homework. Thorndike believes that practice is a "PREREQUISITE" of learning should be done by students' satisfaction and happiness.

In this philosophy, we must inevitably refer to Skinner's theories. In Skinner viewpoint, natural responses are important. But if this does not lead to the appropriate solution, the teacher should provide the required conditions in order to reaching the solution. Skinner designs a separate curriculum for each student, according to his abilities and disabilities. Overwhelming encouragement has a thriving role, but there is no punishment. There isn't no place for lectures at this philosophy.

In moderation behaviorism philosophy, it has been accepted that students have different levels of learning skills. Students with different levels of learning must therefore trained in different ways. This style of teaching is called talent-improvement interaction (Romberg, 1993). Modern schools should assign different teaching styles to different student groups with different talent levels.

Gestalt's theory emphasizes on meaningful contents and understanding of concepts. Understanding the question is the first comprehensive task. In this theory, the components should be linked to the whole so as to be meaningful to the learner. Solving the problem is significant for solver as a good meal for a hungry person. Teacher helps students to understand the relationships between concepts and organize their experiences in meaningful patterns. Planning a learning experience involves starting with something familiar and step-by-step progress, so that each step is based on the previous step. Pointless memorization of contents assumes undesirable. It's only through getting familiar with the principles of a learning experience that learners understand the fundamental points correctly and thoroughly (Schultz, 2014).

Some elite scholars of this philosophy believe that the meaning of the impact of the field on the learning process is not just the context of the place or culture, but also contain the personal and internal context of individuals (Van Oers , 1998). Brunel believes that even children who are taught in an educational system with similar facilities , have a different understanding of numbers and the ways of employing them (Kilpatrick, 1977). He also believes that even a lesson like numeral theory has two functions: 1) a function as a part of mathematics; 2) social function! In addition to teaching this lesson as a part of mathematics, children's intelligence is gradually rising and, during the learning process, children learn how to solve problems in a variety of ways that come into their daily lives (Kilpatrick, 1977). It should be noted that in comparison with the behaviorists, the place of meaning is the special interest of these psychologists.

According to the above mentioned points, eight mathematical education styles can be expressed as follows:
1) Lecturing Approach: An approach which it is better to call it a patriotic approach. The teacher prepares for everything and, ultimately, the assessment and testing of students is based only on the teacher's oral presentations in the classroom, and students only have the role of retaining the information.
2) Interactive Speech Approach: The approach that a teacher, presents a lecture, and tries to interact with students about the arguments of the theorems or the necessities of the definitions provided.
3) Practical approach: The teacher demonstrates the algorithms, definitions, and sentences by presenting various exercises during the presentation of the lesson and their collaborative solution. This approach is based on the Thorndike's functionalistic viewpoint.
4) Algorithmic Approach: An approach in which the teacher introduces hundreds of algorithms for various problems, and the overall task is to address one of these algorithms without the need to know why it is working efficiently. It can also be called the minecraft approach.
5) Problem-Solving Approach: An approach that transforms the classroom into a problem solving workshop. This approach is based on the Gestalt's cognitive philosophy. According to the NCTM's standards, "Solving problems is not only a goal of learning mathematics but also a major means of doing so. ... In everyday life and in the workplace, being a good problem solver can lead to great advantages. ... Problem solving is an integral part of all mathematics learning "(Pehkonen, 2008).
6) Creativity-Oriented Approach: Ability to understanding mathematics is directly related to individual creativity. By developing creativity skills, teacher could help them learn mathematics.

7. Cognitive approach: This approach is the same as Piaget's epistemological approach. Since the people living in a region have more cognitive similarities, the teaching method can be considered based on the area. Student failure in mathematics is not only based on the external factor, such as the teacher's inability or the inadequacy of the teaching style, but also the cognitive and intrinsic factors can be plotted as internal factors.
8) Discovery Approach: This approach is the Socratic approach that regards knowledge as "hidden" in the essence of human beings. The teacher should guide the classroom with appropriate questions and directions to discover knowledge.

Research Questions

1. What kind of teaching methods do students like the most and do they approve the commonly used booklet-based method?
2. Does the type of gender affect mathematics learning style? In other words, should girls and boys be involved in separate teaching methods?
3. Piaget's cognitive factors are effective in the learning of empirical sciences. Are these internal factors effective in how to learn mathematics?
4. How much does personal experience affect the individual thinking and attitudes towards mathematics teaching styles? This question is based on the theory of constructivism.

Method

In this study, the target community is the undergraduate students in mathematical sciences in Zabol University (case study). Statistical analysis of data is descriptive-analytic. Based on the predefined fundamental concerns, a questionnaire with 48 questions was prepared and used. The number of questionnaires, which consisted of 99 respondents who were filled personally. Preliminary data analysis (data screening) extracted from completed questionnaires showed that no variable has enough lost data to be removed (Tabachnick, 1996). EM algorithm method was used to replace the lost data (Tabachnick, 1996). In this manner Missing data is replaced by the response pattern of individuals with other questions.

Results and Discussion

The validity of the questionnaire was verified by experts in the field and the reliability of the questionnaire is almost well established the Cronbach's Alpha coefficient of 0.75.
We present statistical analysis in descriptive and inferential parts. To begin with, we first performed a non-parametric Chi-square test to measure the imbalance the responses to each question between the answer options if respondents differentiate between the options and do not answer five options in a balanced manner. Otherwise, no result cannot be obtained from that question. The imbalance with the relevant test was confirmed for all questions except for a question. (Spreat, 2001)

Table 1. Chi-Square statistic and sig

Indicator	**Response Frequency**					**Chi-Square**	**Sig**
	Very Low	Low	Ineffective	High	Very High		
Lecture App.	1	4	48	29	5	961161	0.000*
Interactive Speech App.	0	2	4	64	17	115.529	0.000*
Practical App.	0	4	14	59	11	85.364	0.000*
Algorithmic App.	1	3	27	45	9	82.353	0.000*
Problem-Solving App.	0	1	7	34	44	601140	0.000*
Creativity App.	0	0	0	40	48	0.727	0.394
Cognitive App.	2	3	21	35	26	481345	0.000*
Discovery App.	0	3	30	45	8	571429	0.000*

As you can see in Table 1, except for the Discovery method, in the remaining cases, the difference between the options for the respondents is significant. Regarding to the frequency of responses in the Discovery method, respondents clearly choose the higher choices. Of the respondents, 50.7% were male and 49.3% were female. The relationship of gender with the main indicators is based on the Kolmogorov-Smirnov test (Gibbons, 2003), at the alpha level of 5% in Table 2.

Table 2. The gender relationship with respect to the the Kolmogorov–Smirnov test

Indicator	the Kolmogorov–Smirnov test	Sig
Lecture App.	01569	0.903
Interactive Speech App.	01805	01536
Practical App.	01492	0.969
Algorithmic App.	0.836	0.487
Problem-Solving App.	0.492	0.969
Discovery App.	01718	0.682
Creativity App.	2.125	0.000
Cognitive App.	1.201	0.112

As can be seen in Table 2, based on the respondents' response, the gender variable only affects the Creativity approach. For more accurate statistical analysis, Friedman's nonparametric test (Hollander, 1999) has been used to compare the indices based on the responses. The results are presented in Table 3:

Table 3. Mean ranks and Friedman's non-parametric test

Indicator	Mean Ranks	Indicator	Mean Ranks	Friedman's Test	
Interactive Speech App.	5.67	Problem-Solving App.	5.83	number	74
Practical App.	3.98	Discovery App.	6.34	Chi-square	147.863
Algorithmic App.	3.36	Creativity App.	4.29	Degree of freedom	7
Lecture App.	2.85	Cognitive App.	3.68	sig	0.000

According to Table 3, since the equal median hypothesis has been rejected for the main indicators, there is no doubt that there is a statistically significant difference between the responses of the respondents to the indicators. Based on the ranks table in table 3, the best indicator for respondents is the discovery method and problem-solving method, and the least indicator is the lecture-based method. Of course, the same results were achieved.by comparing the means.

In Table 4, you will find a descriptive report of the respondents' answers to the main indicators:

Table 4. Descriptive Report

Indicator	Numbers	Mean of Responses	Standard Deviation	Variance
Lecture App.	84	3.3908	±0.69922	0.4889
Interactive Speech App.	87	4.1412	±0.50177	0.2518
Practical App.	88	3.7670	±0.58574	013431
Algorithmic App.	85	3.5647	±0.68289	014663
Problem-Solving App.	86	4.2035	±0.62487	013905
Discovery App.	88	4.3466	±0.40370	011630
Creativity App.	84	3.7011	±0.96286	019271
Cognitive App.	84	3.6446	±0.60548	0.3666

Based on the mean of the answers of the respondents, the discovery method has the most satisfaction from the respondents' viewpoint and the least amount of comments is also devoted to the lecturer-based method. Using the Mann-Whitney non-parametric test, the impact of gender, and student-teacher relationship factors were studied according to 8 main indicators, and the results are presented in Table 5.

According to this table, the gender factor only affects the indicator of creativity and cognitive factors. Regarding the mean of ranks (based on the output of the software for the Mann-Whitney test) for the creativity indicator, we conclude that women are significantly more likely to believe in creativity-based approach of teaching. In addition, women significantly consider the influence of cognitive factors on math learning. The student-teacher relationship factor, is also effective only on the practice-centered and discovery methods, and in fact the students have significantly more confidence in the practice-oriented approach. Teachers are more interested in the discovery method.

Table 5. Mann–Whitney U test and the effect of gender and level of education on criteria

Factor	Indicator	Statistic Test: Mann-Whitney	Sig
Gender	Creativity App.	160.500	0.000**
	Cognitive App.	329.000	0.049*
Lecturer/Student Factor	Practical App.	207.000	0.039*
	Discovery App.	220.500	0.046*

The dependence of the indicators was then studied using Spearmans rho's nonparametric correlation coefficient. (Table 6)

Table 6. The correlation coefficient between indicators

	Interactive Speech App.	Practical App.	Algorithmic App.	Lecture App.	Problem-Solving App	Discovery App.	Creativity App.	Cognitive App
Interactive Speech App.	1	0.33**	0.074	0.012	0.297**	0.416**	0.098	0/212
Practical App.		1	0.366**	0.442**	0.356**	0.245*	0.119	0/363**
Algorithmic App.			1	0.392**	0.228*	0.175	0.204	0/851**
Lecture App.				1	0.233*	0.127	0.234*	0/346**
Problem-Solving App.					1	0.343**	0.027	0/196
Discovery App.						1	0.030	0/162
Creativity App.							1	0/590**
Cognitive App.								1

The highest correlation coefficient (relationship) between cognitive factors and algorithm wais centered, and the least correlation between lecture-centric method and interactive lecture was found. Interestingly, all correlation coefficients are positive for all correlations.

Conclusion

In this section we study the results of this statistical study. The main results of this research can be divided into two main categories. The first category is the observations that learners prefer the most. The second category is the questions that are considered relevant by the learners.

Learners have less interest in the two common approaches, the lecturer-oriented (pamphlet-oriented) approach and the algorithmic method. On the other hand, the problem-solving approach that makes the classroom a major problem-solving workshop was most endorsed by learners. This approach to the problem-solving can be considered from this point of view, which is an integral part of the secondary education curriculum in countries such as the United States, Australia, Japan, and Singapore (Reyhani et al., 2012). Indeed, the recent survey shows that the common way of teaching and teaching mathematics in Iran is not only inefficient and inadequate, but also the learners are not happy about it. After this approach, Socratic attitude and discovery method have been considered the most. In this preference, the gender factor is not important, that is, both female and male students prefer the problem-solving problem and discovery approaches over the lecture-oriented (booklet) and algorithmic approaches. Ignoring these two teaching methods - which, incidentally, are very similar to each other - interactive lectures are of interest to learners. Learners suggested that this method could be improved by using numerous exercises and solving them by students.

Teachers should encourage the curiosity of students and guide them to solve mathematical problems. This tutorial is very time-consuming and new educational books should be written for. The solving exercises improves student's learning while teaching theoretical debates. Then, by assigning training classes in the educational programs and setting targeted exercises, the class of practice solving transforms from dictation manner to the challenging and interactive class .Learners also believe that the solution to math problems is not unique and naturally expect teachers to accept their various correct solutions.

References

Behboodian, J. (2006). Nonparametric statistics,ShirazUniversity Press,Shiraz.[in Persian]

Bjork, D.W. (1998). Burrhus Fredrick Skinner: The contingencies of a life. In G.A. Kimble and M. Wertheimer(Eds.), Portraits of Pioneers in Psychology, 3, 261-275. Washington, D. C., American Psychological Association.

Gibbons,J. D. and Chakraborti,S. (2003).Nonparametric Statistical Inference, 4th Edition, Marcel Dekker,New York, 645 pp.

Hollander, M. and Wolfe, D.A. (1977). Nonparametric Statistical Methods, 2nd ed. New York: John Wiley & Sons,Inc. 10. Kilpatrick, J. and Weaver, J.F. The Place of William A. Brownell in Mathematics Education. Journal for Research in Mathematics Education, 8, No. 5, 382-384.

Mullis,I.V.S,, Martin,M.O,, Gonzalez, .J., Gregory,K.D., Garden, R.A., O'Connor, K.M., Chrostowski,S.J.,& Smith T.A. (2000).TIMSS 1999 International mathematics report findings from IEA's repeat of the Third International Mathematics and Science Study at the eighth grade. Chestnut Hill, MA: Boston College. Available online at http://www.timss.org.

Pehkonen, E. (2008). Problem solving in mathematics education in Finland, p.3,www.unige.ch/math/ EnsMath/ Rome2008/WG2 /Papers/ PEHKON.pdf.

Reyhani, E, Ahmadi, G. and Karami zarandi, Z. (2012). Comparative study of problem solving process in mathematics teaching programs of United States, Australia, Japan, Singapore and Iran, Quarterly Journal of Education, 105, 116-141.[in Persian]

Schultz, P. D. (2014). Theories of personality. (translated by Y. Karimi et al.), Arasbaran.[in Persian]

Sha'bani,H. (2008). Educational and developmental skills, Samt.[in Persian]

Spreat, P. and Smeeton,N.C. (2001). Applied Nonparametric Statistical Methods, 3rd Edition, Boca Raton: Chapman & Hall/CRC.

Tabachnick, B. G. and Fidell, L. S. (1996). Using Multivariate Statistics. New York: Harper Collins.

Tatto, M. T., Schwille, J., Senk, S., Ingvarson, L., Peck, R., & Rowley, G. (2008). Teacher Education and Development Study in Mathematics (TEDS-M):Policy, practice, and readiness to teach primary and secondary mathematics. Conceptual framework. East Lansing, MI: Teacher Education and Development International Study Center, College of Education, Michigan State University

Van Oers, B.(1998), From Context to Contextualizing, Learning and Instruction. Elsevier Sciences Ltd. 8, 473-488.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9 , Pages 224-228

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

The Post-Failure Thoughts' in Mathematics Problems Solving Amongst Gifted and Normal Pupils

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Abstract: This study aims at investigating the post-failure thoughts' in mathematics' problems solving amongst gifted and normal pupils in the Middle School in Ouargla- Algeria. The study adopted the data collection on the mathematics teacher's appointments, and the Raven intelligence test to identify the gifted and the normal pupils, Also use the mathematical problems, and open questionnaire to determine the post-failure thoughts' in problem solving in mathematics. The sample consisted of (79) pupils in middle school. The outcomes showed: 1 - The post-failure thoughts' are: the thoughts of challenging, and thoughts of stopping. 2. There are significant differences at 0.05 in the thoughts of challenging between gifted and normal pupils favor the gifted pupils.

Keywords: Post-failure thoughts', Mathematical problems, Gifted

Introduction

The interest in caring for the gifted and their needs is an inevitable result of the stage of development that the society is going through. We cannot take one step towards progress without training the talented of our children by knowing their needs and providing sufficient opportunities to develop their abilities so that their abilities and energies can be invested to the maximum extent. It is an educational right for every gifted and normal pupils. Among the rights of the students is the right to error while solving problems or engaging in any thought process directed through dealing with a situation. Learning from error is rooted in the theory of learning by the attempt and error of Thorndike, and by the contributions of the philosopher Bachlard who said: "The truth is a rectified error" and to Popper's work which he said: "I tried to show that our knowledge grows through trial and error-elimination, and that the main difference between its prescientific and its scientific growth is that on the scientific level we consciously search for our errors: the conscious adoption of the critical method becomes the main instrument of growth" (Popper, 2002, p. 131) . It should be noted that most of the educational theories are concerned this concept, Including: Behavioral, Gestalt, and Structural Theory.

The role of failure in learning and problem solving is no doubt intuitively compelling. Research on impasse-driven learning in coached problem-solving situations provides strong evidence for the role of failure in learning, in general, and in problem solving. As the goal of most instructional methods is to maximize students" performance on the long term (retention) and outside the instructional context (transfer), a solution to reach this goal is called for. An instructional method called productive failure could be a fruitful solution. Productive failure starts from the assumption that people can learn from their own mistakes, and that instruction should be delayed until after experimenting (Kupur, 2008). VanLehn, Siler, Murray, Yamauchi and Baggett (2003) reported that learning of a new physic concept is related with failure, which means that it would be better to delay the instruction until after the students reach an impasse and are not able to go on with the task. Mathan and Koedinger (2003) conducted an experiment using two different feedback conditions. In one condition, the tutor offered immediate feedback on errors. In the other, the tutor waited to see whether learners detected their own errors, and attempted to guide them

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through detecting and correcting their mistakes only if they attempted to move on to a new problem. Findings from this study indicated that while the learners in the two groups performed similarly on the first problem, those in the delayed feedback condition learned at a faster rate on all subsequent problems (Wise & O'Neill, 2009). The most of the studies were conducted in a high school context in which productive failure turned out to be effective (Kapur, 2008, 2009, 2013). Finally, the experience of failure could lead to negative emotion, lowered self-esteem, reduced intrinsic motivation, and lower expectancies of future success (Chase, 2011;Rausch,Seifried, and Harteis, 2017).

Bandura pointed out that the a talented person has judgments and expectations about his performance in ambiguous situations which harms the selection of appropriate strategies to resolve ambiguity and face difficulties (Bandura, 1997).

Through the above we note the following:
Literature emphasized the importance of the strategy of productive failure and the role of failure in learning and psychological situations that may accompany the failure, but did not describe what happens after the failure. Also the educational theories did not clearly indicate what thoughts come to our mind after failure.
There are few studies that have addressed the issue of failure.
Hence, this study comes to investigate the post-failure thoughts" in solving the mathematical problems amongst gifted and normal pupils by asking the following questions:
Study questions.

- What are the post-failure thoughts' in solving mathematical problems among middle school pupils?
- Do post-failure thoughts' differ in solving mathematical problems among pupils (gifted, normal)?

Hypotheses.

- post-failure thoughts in mathematical problem solving are to challenge and/ or to stop((reluctance) thoughts among sample (gifted, normal).
- there are no significant differences between gifted and normal pupils in post-failure thougts".

Method

The descriptive approach is the most appropriate approach to this study

Participants

The sample of study was 79 pupils(45 gifted, 34 normal) from 5 middle schools in Ouargla, Algeria,

Instruments and Procedures

The data of this study were collected through the following:

Teachers' observations

The researcher asked mathematics teachers to identify their gifted pupils in mathematics (ask puzzling questions, think deeply about mathematical problems, solve mathematical problems in different ways, and does not require to be high-achieving pupils)

Raven's Progressive Matrices

The Raven Standard Progressive Matrices (SPM; Raven, 1938) is a test of nonverbal reasoning ability and general intelligence (the so-called g factor; Spearman, 1927) that minimizes cultural bias. The Raven SPM contains 60 items that are arranged in five sets of 12 items each (Sets A, B, C, D, and E). Each item requires the examinee to infer a rule relating to a collection of elements and then use this rule to verify that a presented element is a legitimate relative to the rule. (Van der Elst et al., 2013)

Mathematical Problems

I designed three mathematical problems, one problem for each level (second, third, and fourth grade). The duration of each problem was 20 minutes. Four math teachers at the middle school level agreed that the difficulty of these problems was appropriate, unusual and relevent to the curriculum.

Open Questionnaire

It is a paper with an open question asking the participants to identify their thoughts after engaging in solving the mathematical problem.

Procedures

After taking the authorization from the Directorate of Education in the Ouargla province to conduct this study, the researcher randomly selected 5 middle schools . I asked The mathematics teachers in these schools to identify the gifted and normal pupils in mathematics. They nominated 195 pupils (102 gifted, 93 normal). Then i applied the Raven test and converting scores to percentiles. According to Raven, the gifted is the higher than or equal to the percentile 95(corresponding to score 47) and the normal pupil is between 75 and 95 percentile(greater than 40 and less than the score 47 (Bensaci, 2014). after two weeks we provided for each level a mathematical problem for 20 minutes. then, pupils were given an open questionnaire sheet to describe their thoughts precisely after solve the problem.

Results

H1: post-failure thoughts" in mathematical problem solving are challenge and stop(reluctance) thoughts among sample (gifted, normal).

Table 1. Challenge thoughts, classification of pupils, frequencies and percent

01	MY thoughts were confused but after the focus and insistence, i solved it	GIFTED	17	21,52%
		Normal	7	8,86%
02	I got a bit confused at first, but I can solve problems more difficult than this problem	Gifted	6	7,59%
03	This problem needs a longer focus and time, but I am going later solve it to myself . I must take it as a lesson to make more effort in learning mathematics	Gifted	3	3,80%
		Normal	3	3,80%
04	Although the problem was difficult but I was telling myself I must find some way to solve it.	Gifted	2	2,53%
		Normal	2	2,53%

Challenge thoughts" focused on four main ideas . The most common thought is the first one" My thoughts were confused but after the focus and insistence, I solved it", which was the answer of 17 gifted (i.e.21,52% of the sample).The less common idea is the "fourth idea", which is equal in the answer gifted and normal pupils(2 for each classification2.53%), While not was answered the second thoughtonly gifted(6 i.e. 7.59%). The third thought, the gifted and the ordinary were equal in answered (3i.e. 3.80% for each classification). As a result, the total number of gifted whose thoughts after failure were challenge (28, i.e.35.44%), However were(17, i.e. 21.52%.).

Table 2. Thoughts of stop(reluctance), classification of pupils and percent

01	I found it difficult to understand the problem and decided to stop thinking about solving it	GIFTED	5	6,33%
		Normal	11	13,92%
02	I lost confidence in my abilities	Gifted	6	7,59%
		Normal	3	3,80%
03	I feel like i did not learn mathematics.	Gifted	2	2,53%
		Normal	3	3,80%
04	I am desperate to solve this problem.	Gifted	2	2,53%
		Normal	3	3,80%
05	I feel my mind stop	Gifted	2	2,53%
		Normal	2	2,53%

The thoughts of stop (reluctance) centered on five main ideas. The most common idea was the first one" I found it difficult to understand the problem and decided to stop thinking about solving it", which was the answer of 11 normal pupils, which represented 13.92% of the sample, and 5 gifted by 6.33%. Followed by the second idea "I lost confidence in my abilities" it was the opposite of all other thoughts of stop, where it was the answer of 6 gifted(i.e. 7,59%), and 3 normal pupils(i.e. 3,80%).While the third and the forth thoughts were equal in frequency of gifted (2) and normal pupils (3).The fifth thought "I feel my mind stop" the number of gifted (2) and normal (2) whose answered it. In total, the number of gifted pupils whose thoughts of stop(reluctance) were 12(i.e. 15.19%), was lower than the percent of normal pupils(22,i.e. 27.85%). Therefore, the thoughts of challenge were more prevalent among the gifted. While the thoughts of stop (reluctance) were more prevalent among the normal pupils.
H2: There are no significant differences between gifted and normal pupils in post failure thoughts‟.

Table 3. Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5,618	1	0,018
Continuity Correctionb	4,593	1	0,032
Likelihood Ratio	5,689	1	0,017

Table 3 shows X^2(5.618, 0.018), Therefore I reject the null hypothesis and accept the alternative hypothesis that There are significant differences at 0.05 in the thoughts of challenging between gifted and normal pupils favor the gifted pupils.

Discussion and Conclusions

This study aimed at revealing post-failure thoughts‟ in solving mathematical problems. It reached two kinds of thoughts: thoughts of challenge, and thoughts of stop(reluctance), and showed that gifted pupils had more challenging thoughts than simply giving up. Outcome of second hypothesis emphasized the result of the first one, "There are significant differences at 0.05 in the thoughts of challenging between gifted and normal pupils favor the gifted pupils". It means the gifted pupils face their problems (Bandura, 1997). This can be explained that gifted pupils are more patient and challenging than normal pupils. They are involved in solving problems that are so difficult and they trust their abilities. This is what we found in one of the answers: "I got a bit confused at first, but I can solve problems more difficult than this problem" These results may explain that gifted have more experience than others in failure. They have already tried difficult problems and failed, which led to accumulate new experiences of challenging. Failure can also lead to instability. Continuing to try again until the solution is achieved is an expression of the demand for adaptation to the new situation, as expressed by Piaget (Woolfolk, 2010). The gifted are also more self-organized than the normal (Sabatin, 2006), and maintain their enthusiasm until they solve the problem they face. However, through Table 2, we noticed that some gifted had thoughts of stop. This can be explained that other factors intervened in guiding the behavior of this classification, such as motivation, emotion and anxiety (Chase, 2011), negative reactions of the teacher and the classmates, individual beliefs, and contextual factors (Tulis, Steuet, and Dresel, 2015). As we observed that some normal pupils have challenge thoughts‟. We can explain that they either have previous experiences in failures learned from dealing with failures through support from their teachers, classmates, and parents. Or that the measuring instruments could not detect that they were gifted. Therefore, the design of more sensitive measurement tools should be planned to detect the gifted in mathematics.

References

Bandura, A. (1997) Self-Efficacy: The Exercise Of Control , W.H. Freeman, New York. Instruction, 26(3), 379-42.

Bensaci, O. (2014) metacognition in Mathematics is one of the determinants of its creators among the third level pupils in Middle School, The First International Conference for the Care of the Gifted Towards a national strategy for the care of gifted and talented in Algeria, University of Blida 2, 29-30 November 2014.

Kapur, M, & Toh, P.L.L(2013) . Productive failure : from an experimental effect to a learning.desing.inT.plomp, & N.Nieveen (Eds), Educational desingresrarch- part B: illustrative cases.

Kapur, M. (2009). Productive failure in mathematical problem solving. Instructional Science. doi: 10.1007/s11251-009-9093-x.

Kapur, M. (2008). Productive failure. Cognition and Instruction, 26(3), 379-424.

Popper, K. R. (2002). Unended Quest: An intellectual autobiography, (2nd ed.), London: Routledge.

Rausch, A., Seifried, J. and Harteis, C. (2017). Emotions, coping and learning in error situations in the workplace. Journal of Workplace Learning. DOI https://doi.org/10.1108/JWL-01-2017-0004.

Sabatin, A. (2006). A Comparative Study of Metacognitive Thinking Skills-Level between Gifted and Nongifted Students of Intermediate Schools in Mecca (Unpublishedmagistrate thesis). Amman Arab University, Amman, Jordan.

Swelle,J.(2010).what human cognitive architecture tells us about constructivism.S . Tobias &T. M. Doffg (Eds), New York, NJ: Routledge.

Tulis, M., Steuer, G., and Dresel, M. (2015), „Learning from errors: process and contextual conditions. Towards a model of individual processes within contexts‟, in Gartmeier, M., Gruber, H., Hascher, T., and Heid, H. (Eds.), Fehler. IhreFunktionenimKontextindividueller und gesellschaftlicherEntwicklung [Errors. Their Function in the Context of Individual and Societal Development], Waxmann, Göttingen, 53–70.

Van der Elst, W., Ouwehand, C., van Rijn, P., Lee, N., Van Boxtel, M., and Jolles, J. (2013). The shortened raven standard progressive matrices: item response theory–based psychometric analyses and normative data. Assessment 20, 48–59. doi: 10.1177/1073191111415999

VanLehn, K., Siler, S., Murray, C., Yamauchi, T., & Baggett, W. B. (2003). Why do only some events cause learning during human tutoring? Cognition and Instruction, 21, 209– 249.

Wise, A., and K. O‟Neill. 2009. “Beyond More versus Less: A Reframing of the Debate on Instructional Guidance.” In Constructivist Instruction: Success or Failure? edited by S.Tobias, and T. Duffy, 82-105. New York: Routledge.

Woolfolk, A. (2010). Educational psychology (11th ed.), London: Pearson Education.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 229 - 238

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Educational Games and Activities in Preschool Mathematics

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Abstract: The core preschool curriculum currently binding in Poland sets forth the objective of pre-school education, the preventive and educational tasks of kindergartens, preschool departments in primary schools and other forms of preschool education, and the results of their implementation, i.e. the goals which children attain on completion of their preschool education. The objective of preschool education is to support the full development of children. This assistance comes in the form of care, upbringing and teaching & learning processes, which allow the child to discover its potential, get to know the logic of actions, and to gain experience on its road to truth, goodness and beauty. As a consequence, the child becomes mature enough to enter the first level of education. Preschool education defines educational contents as the elements of culture that are intentionally selected and included in the process of education. Cultural contents are the most crucial means of educational activity in preschools, as thanks to them the child absorbs the social achievements of many generations and may develop as a human being. Hence, in practice, preschool educational contents are classified, according to the domain of culture producing various type values, into:

- mental education including speech and thinking development (Polish language education), introduction to the qualitative and quantitative relations and mathematical concept development (Mathematical education), discovering nature (Scientific education),
- aesthetics education,
- social and moral education,
- health education.

Mathematical education is one of the most difficult areas of education. Maths is often not only non-supportive in terms of child's intellectual development, but in some children it can also impede or distort their personalities. As early as in preschool, children often experience failures, which may cause real drama. Consequently, many children are afraid of Maths and tend to avoid, by all means, any out-of-school situations associated with it. Research demonstrates that every fourth child at the end of the first grade/the beginning of the second grade experiences difficulties with Maths; whereas, every third child in the third grade cannot meet the requirements of the class. The main causes of the fear of and aversion to Maths are preschool failures. Thus, how to organise Mathematics so that they bring the desired results? It seems that to help the child reach the level of curricular requirements, often a simple introduction of other exercises, suited to the child's abilities and difficulties it experiences, would suffice. The article presents analyses regarding the influence of educational games and activities on the level of mathematical skills of 5-year-olds within the Siedlce city area (Poland). Research included 380 six-year-olds and 40 teachers. The first study was conducted in November and the second – in April, after a five-month mathematical education with the use of educational games and activities.

Keywords: Educational games, Educational activities, Mathematical education, Six-year-old, Kindergarten, Mathematical skills

Introduction

Mathematics is more than a formal construction or a supply of ready-to-go knowledge, which can be acquired. It is a way of approaching the world, a means to understand it better. "It ought to be taught, primarily, as a useful tool, a reasoning method" (Filip & Rams, 2000, p. 9).

Mathematics is more than just formulas and theories. It is knowledge determining the way in which the universe functions. When one enters digits into a calculator, s/he actually has an insight into universe's mysteries. Every

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calculation made by a man renders its brains quicker and more flexible. Solving complicated exercises, pondering about a problem, develops imagination, provides a greater insight into oneself, one's skills, and the beauty of Mathematics (Skura, 2009, p. 42).

Mathematics, quite like the reading skill, is a tool for exploring the reality. mathematical skills and information are requisite in the learning of other school subjects. It is a subject featuring high educational values, for to master the notions and use them in practice logical thinking skill must be developed (Filip & Rams, 2000, p. 80).

Mathematical education is a crucial area of education at the preschool level. The conditions we create for our child to explore the world of Mathematics will determine whether his attitude to it will be creative or quite the opposite. As a school subject, Mathematics must be viewed from a dual perspective. On the one hand, we must consider the special nature of Mathematics as a science that is expressed, inter alia, by the operative nature of notions and by a separate language code, which allow mathematicization of certain situations. On the other hand, we need to account for all physical and mental abilities of a child, his/her level of perception and understanding of the world around" (Nowak, 2011, p. 28).

When acquiring Mathematics, children should solve tasks thanks to which their natural curiosity will be satisfied and the ability to draw on their own experience and knowledge about the world will be developed. Activities organized by the teacher, during which children manipulate with objects, help them expand mathematical knowledge. Tasks that require some operations are necessary for normal intellectual development of preschool children's talents and wisdom. An indispensable element of said experience and the related learning process should be a relaxing, fun atmosphere, and a feeling of satisfaction. It is in child's interest that he is provided with mathematical exercises that will show him/her that Maths is not only accessible, but also highly interesting and funny (Pisarski, 1992, pp. 10-11).

It is said that to have good results in Maths, you need special skills. A lack of such abilities is the main reason of struggles and failures. Research conducted by psychologists refute this theory, for excessive difficulties and related failures associated with the learning of Mathematics are not a consequence of the lack of abilities, but rather of a delay in psychological processes' development required to learn Maths. A frequent cause of failure is an unsuitable choice of teaching methods for preschool children. We need to bear in mind that the principal form of child's activity at this age are games. It is thanks to them that the child discovers the world and social relations, shapes his mind and effective operational skills, satisfies his/her need to be active, establishes positive emotional states and eases emotional tension (Klim-Klimaszewska, 2005, p. 39).

Adequately selected didactic contents and the application of variable teaching methods when working with children and implementing mathematical education in preschool has positive effects – a child that begins education in a primary school can meet its requirements and cope with mathematical obstacles. One of the numerous methods facilitating the acquisition of mathematical skills includes didactic or educational games. During play time and didactic games children learn Maths with pleasure.

The Position of Educational Games in the Teaching of Preschool Children

Contemporary preschools should consciously and consequently organize activities which stimulate an active and creative attitude in every child. One opportunity to do so are didactic (or educational) games. They are a vital measure of development of correct attitudes to learning, cooperating with other children, and to the surrounding reality. They are important factors that optimize the process of upbringing and teaching in preschools. They minimize difficulties and failures children experience during preschool activities (Rynek, 2003, pp. 545-546).

Fun didactic activities and educational games have a deep-rooted tradition in teaching and upbringing. Plato, for instance, believed that upbringing and teaching must be founded on unconstrained methods, such as didactic games, and never on constraint. An occasional variation to classes in a form of "scientific games" could be observed also in Quintilian's. Jan Amos Komeński advised that reading was taught in a play-like manner, using a moving alphabet; he emphasised the role of didactic games in his approach to the upbringing of young children of Jan Henryk Pestalozzi (Kędzior-Niczyporuk, 1998, p. 16).

Educational games are one of the means of managing one's intellectual development. For children – they are an attraction; in the case of teachers – they support the didactic and educational process and diversify educational situations. While delivering the pleasure of intellectual efforts, stimulating thinking, they enrich and reinforce skills and make them practicable (Kamecka, 2004, p. 39).

Didactic games expose children to active perception (discovery through senses), assimilation activities (acquisition/revision, especially with the use of memory), and exploration activities, i.e. discovering new elements of knowledge (discovery-like and creative activities). The teaching through educational games and activities comprises all underlying elements of comprehensive teaching, i.e. learning through cognition, experience and action (Łukasik & Cyran, 2002, p. 309).

The introduction of educational games into the teaching process develops perceptive-motor processes, the ability to observe, imagination, concentration, memory and mental processes, such as analysis, synthesis, classification, comparison, disregard, understanding and generalization.

Educational games provide an opportunity to acquire skills and habits necessary to master preschool knowledge, and in the future – to learn in school and then work (Okoń, 1987, pp. 261-262).

Educational games promote generation of "task-oriented motivation", thanks to which a child is willing to do certain tasks, as s/he derives pleasure from it. Fun-based teaching&learning methods are particularly useful when working with children with speech impairments. They help one ease preschool and out-of-preschool stress and organize group activities. They play a therapeutic role in relation to children with developmental deficits or retardation (Błanik, 1999, p. 103).

Preschool environment is significant to the acquisition of correct experiences and mathematical notions, whereas early experiences of children are key to the process of shaping adequate mathematical terms. And it is Mathematics, where educational games are used to a very large extent. They make Math classes more attractive. They release mathematical activity. What is more, they facilitate the understanding of novel terms and skill development, they develop cognitive needs, and stimulate mental activities of a child by teaching him/her to explore, discover, and express the data acquired (Iwańska, 2001, p. 227).

The role and importance of didactic games at the level of preschool education and teaching cannot be overestimated. Due to their qualities and unlimited applications, they can play a servant role in the process of teaching, supporting realization of a number of didactic and educational objectives and activities (Błanik, 1999, p. 138).

The use of educational games in preschool education has a positive effect on child's development. Didactic games structure multiple cognitive and social skills, such as problem solving, negotiating, or discussing. They teach children self-control, competition and cooperation techniques. They train agile minds and nimble wits. When children are involved in a didactic game, they encounter information, reconstruct it and create a new one; therefore, it is easily memorised, long-lasting and can serve as a future resource (Kruszewski, 2004, p. 238).

Educational games develop quick wits, ingenuity, and the ability to take in swiftly. They teach how to express one's thoughts in a succinct and intelligible manner. The objective of educational games is, above all, intellectual education. However, they also require children to be willing, to act according to a given plan, to master and abide by the rules of the game, to focus on the interest of the group rather than on their own first (Bleher, 1952, pp. 8-9).

Thanks to educational games, one gains paramount logical and mathematical experience, i.e. classifying elements in line with a predetermined criterion, searching for a criterion guiding the existing series, putting various parts together to make a whole, searching for repeatable patterns, comparing set sizes, calculating, determining varying potentials, evaluating results of arithmetic operations (addition and substraction) (Klim-Klimaszewska, 2010, p. 218).

For didactic games used in mathematical education to perform well, the following rules should be met:

1. Children ought to undertake and carry out educational games with pleasure, not due to an obligation. Therefore, teachers can only suggest didactic games/activities, rather than impose them.
2. Games/activities should be make-believe/invented only, but at the same time – dependent on the appearance of the real world. The make-believe convention favours the feeling of safety and children can, without any fear, practice skills to be used in real life situations later on in lives.

3. When organizing educational games, rules must be imposed very thoughtfully, so that they do not turn into a task to be done. Teachers should brief their pupils on the general idea of a given game, and then agree on the way they can play, allowing the children to, for instance, modify its course.
4. One ought to bear in mind that while every game is for fun, not every kind of fun is a game. Games incorporate rivalry and preschool children know very well that they will race one another for something, whereas mere playing does not involve the element of competition. Hence, the teacher should be cautious not to call fun activities/playing games and games – fun activities/playing.
5. Before any educational game or fun activity, one needs to check if it features the type of cognitive and performative experience that will contribute to the formation of mathematical competencies crucial form the point of view of a lesson plan (Gruszczyk-Kolczyńska & Zielińska, 2004, pp. 43-44).

Method

The subject of research was mathematical education. The study was conducted with a view to verifying whether educational (didactic) games used by teachers can affect the level of mathematical education presented by children attending preschools in the Siedlce city area.

The research problem was narrowed down to two questions:

1. What educational (didactic) games are used by the study teachers during mathematical education classes?
2. What is the level of mathematical education presented by the study group children?

To conduct the study, a diagnostic survey method was applied, which involved techniques, such as:

- a questionnaire,
- a pedagogical test.

The study was performed twice: in November 2016 and April 2017. Analyses included 380 six-year-olds and 40 teachers (females). The children were tested for mathematical skills. They had the following tasks to do:

1. Look at the pictures closely and then follow the instructions underneath.
   - Colour what is in front of the fence.
   - Colour what is behind the boy.
   - Colour what is over the earthworm.
   - Colour what is under the table.
   - Colour what is next to the cat.
2. Circle all animals and objects looking left BLUE, and all those looking right RED.
3. Draw the sun on the top right and a cloud on the top left. Draw a red flower at bottom right and a vehicle you would like to use at bottom left.
4. Draw geometric figures by connecting the dots with a single line, following the direction of the arrows. Colour the circles red, the squares blue, the rectangles green and the triangles purple.
5. Match the fruits with relevant baskets.
6. Count the suns in the box In the next box, draw the same number of suns plus one.
7. Count the clouds in the box. In the next box, draw the same number of clouds plus one.
8. Count the hearts in the box. In the next box, draw the same number of hearts plus one.
9. Colour the fourth apple, the first pear, and the third strawberry (starting from the left).
10. Colour as many sunflower leaves as there are dots in the box next to the sunflower.
11. Basia has got three teddy-bears and six dolls. Inside the frame, draw as many lines as there are Basia's toys.
12. Filip had five lollipops. He has eaten three of them. Cross out as many lollipops as Filip has eaten. Inside the frame, draw as many lollipops he has got left.
13. A circle, a heart, a triangle, a circle, a heart, a triangle. What is next? Continue according to the pattern given.
14. Look at the pictures and the figures below them. In the second line under the pictures, draw relevant figures.
15. Circle the lowest tree, the biggest butterfly, the shortest crayon, the longest earthworm, the tallest house.
16. It is spring now. Circle the picture which shows the season which follows spring.

Every activity is allocated three levels at which a given skill is performed: A – mastered (the child correctly completed the whole activity), B – under development (the child correctly completed a part of the activity), C – not mastered (the child did not complete the activity or completed it incorrectly).

The teachers were presented with a survey. The survey allowed the researchers to gather information regarding the educational (didactic) games used during mathematical education classes.

Results and Discussion

The first stage of the study was to acquire information from the teachers regarding the methods employed by them during Mathematics. Teachers indicated several such methods each. The results are presented in Table 1.

Table 1. Methods used by the study teachers during mathematics

No.	Methodology	Number of teachers in %
1.	Own experience/discovery method	60
2.	Following child's own activity method	30
3.	Giving children tasks to do method	40
4.	Exercise method	70
5.	Observation and demonstration	50
6.	Teacher's personal example method	50
7.	Disclosing arts	20
8.	Conversations, stories and riddles	70
9.	Explanations and instructions	70
10.	Methods of social communication	20
11.	Living word method	40
12.	Glenn Doman method	20

Data presented in Table 1 indicate that the methods most frequently used by the study teachers during mathematical education were exercises, conversations, stories and riddles, and explanations and instructions – 70% of the study teachers. 60% of the teachers use the own experience method, whereas 50% – observation and demonstration and personal example. Less, i.e. 40% of the teachers, also employ the method of tasks set for a child and a living word method, whereas 30% – the method of directing child's own activity. The least teachers, i.e. 20%, use the Glenn Doman's method to teach Maths. We need to state that the methods proposed by the teachers are traditional methods adopted in preschool pedagogy and they cover all areas of educational work in preschool. They include both the upbringing process and the teaching process and account for the features and stages of child development. The only alternative methodology is the Glenn Doman's method, but it does not contain any elements of educational games or fun activities.

Next, the children were tested for mathematical skills. The results obtained are summarized in the Table 2.

Table 2. Children's mathematical skills test findings – Study I

No.	Analysed skill	% of children		
		A	B	C
1.	Describing location of objects, recognizing and using terms: on, under, next to, behind, in front of	4.3	91.4	4.3
2.	Telling right from left	-	87.0	13.0
3.	Directions/orientation on paper	-	87.0	13.0
4.	Recognizing shapes, naming geometrical figures: a circle, a square, a triangle, a rectangle.	82.6	17.4	-
5.	Grouping and classifying objects according to a given criterion	13.0	78.2	8.8
6.	Counting elements in a set, using terms: less, more, as many as	26.0	74.0	-

7.	Using numerals (cardinal and ordinal numbers)	4.4	87.5	8.1
8.	Counting of up to 10 objects	30.6	65.0	4.4
9.	Determining the result of adding/ subtracting up to 10	-	82.6	17.4
10.	Spotting regularities and capacity to continue them	8.7	82.6	8.7
11.	Naming sizes and lengths, using terms: big, bigger, the biggest, short, long, the same size, longer, shorter, the longest, the shortest	-	91.3	8.7
12.	Recognizing time sequences (day and night, seasons of the year, months)	8.7	82.6	8.7

Date presented in Table 1 show that in Study I, the majority (77.2%) were children who acquired a given mathematical skills in part. The second group (14.9%) were children who correctly completed the whole task. Whereas, children who did not complete the task or completed it incorrectly accounted for 7.9% of all study children.

Next, mathematical activities with the application of educational games were performed for 5 months. The following were used for the implementation of math educational contents:

1. Constructing board games. Board games constructed by children themselves play a vital role in preschool work. They engage children's creative potential and allow expansion of their intellectual abilities. In turn, when rules and the need to follow them are discussed with a child, the children's interpersonal skills are developed and their emotional resistance is shaped. Games children can construct on their own are highly appealing. Children are passionate with creating various variants of a given game and zealously negotiate its future rules. They adjust the rules to the boards, or the boards to the rules, invent numerous tricks and bonuses – everything for the game to be interesting. When a game is no longer attractive, it is modified or replaced with a new one. Game building may be associated with various educational elements. By game type selection, one may make various situations more mathematic-like, learn how to code, decode, use symbols, or create own symbols. Another crucial item is to gain logical and mathematical experience: classifying elements in accordance with a predetermined criterion, determining a criterion for existing series, putting various parts together to make a whole, searching for repeatable patterns, calculating, comparing set sizes, determining varying potential when identifying the winner, and finally – training intensively to calculate the result of addition and subtraction. Classes concerning game building may be conducted one-to-one or with a group of children. When working with a group, the teacher helps children get in pairs in which they will be working. S/he makes sure that every pair consists of children of congruent cognitive and performative abilities. Every game involves a similar-scheme story (a board, pawns, which mark different players, and a race towards the finish line). Games may contain varying adventures – their themes are driven by imagination and inventiveness of children. However, they have similar patterns: animals, people, vehicles etc. race one another following a pre-planned route. All games feature traps and bonuses, which make them more attractive and exciting. The game board is a record of an invented storyline. It must be made on large sheets of paper to be legible. While drawing it, children learn to code information. Numerous symbols, drawings, or words must be easily understood by both parties. The racing players are marked with regular pawns, small pictures or surprise eggs' figures. Another important element is a dice. More advanced game variants involve a mathematics-related plot. They consist of a lesser number of stories, whereas adventures have numerical values. The range of mathematical operations broadens. The method of construing all games is analogous and necessitates the following:

- that a racing route is drawn, i.e. an adequately long path, that special steps are measured within it, and that the start and the finish line are marked;
- that those who are to race are identified, that traps and bonuses are invented and legibly marked along the race route.

In addition, when building a game, children must understand that:

- every player has his/her own representative in the form of a pawn, which may jump over the path's squares,
- children take turns to roll the dice, count the dots, and move their pawns forward by the number of squares they got on the dice,
- you must count the dots fast and must not be wrong – it is also worth checking if all the other players can count correctly,
- at the end of the race, you must roll the dice to get the number of dots exactly the same as the number of squares the pawn has to reach the finish line – if there are more dots, you must wait,

- he, who first reaches the finish line, wins,
- instructions and rules are set during the joint board drawing (every game has a new board drawn).

One needs the following tools to build games:

- paper sheets, Bristol boards, smooth wallpaper scraps, fabrics,
- dices,
- markers, crayons, scissors, colour paper, adhesive tape,
- "surprise eggs" figures,
- little cars,
- animal figures,
- pawns, stones, buttons,
- blocks to measure the path's squares,
- strings,
- lollipop and ice-cream sticks,
- rubber bands,
- clothes pegs,
- dominoes (paper domino is allowed) created by children as needed,
- fine homogeneous objects, such as bean seeds, chestnuts,
- postcards,
- measuring tapes,
- jackstraws,
- playing cards (Klim-Klimaszewska, 2010, pp. 217-219).

2. Tangram. The tangram is a classic logical puzzle, renown and appreciated over the ages. The idea of the tangram originated in China, most probably between the 8th and 4th century BC. It is one of the most popular geometric riddles. It is an absorbing intellectual entertainment providing a lot of satisfaction, when the required figure is ready. The tangram is composed of 7 elements (a square, a parallelogram and 5 different triangles). All the necessary shapes (tans) may be made of a piece of paper cut in a proper way. Playing with tangrams develops spatial imagination, teaches creative and inventive thinking, and stimulates one to seek novel solutions. By playing with the tangram, children practice concentration, perceptiveness and persistence in pursuing objectives. No fixed rules apply to the Tangram, but for one: all tans must be used in order to form a figure and none of the tans can overlap another. Every puzzle may be inverted. Manipulating with the tans, looking for matching figures, comparing, fitting the side lengths – these are activities which allow children to gain experience facilitating recognition of geometric figures and their characteristics. (Pisarski, 1992, pp. 115-117).

3. Origami. Origami is an old Japanese art of paper folding to form sculptures: people, animals, flowers, objects etc. A flat square sheet of paper is folded along straight lines in all directions, forming symmetrical, overlapping surfaces. It cannot be cut, glued or additionally adorned. Paper folding becomes an opportunity to explore the secrets of Maths in an empirical, engaging and fun way. It involves geometry, edges, symmetry axes, sections, or algebra. Folding a circle with the use of its diameter makes the understanding of fractions much easier. Multi-element models made of circles and squares help one grasp issues, such as spatial relations, comparison, subtraction, etc. By creating geometrical figures with folded paper sheets, children can practice spatial orientation, distinguish size-related features, compare and search for common characteristics, evaluate the size and shapes. In addition, they count the tops or edges in polyhedrons they have created; they also estimate the number of homogeneous tops when folding a single origami form. Apart from plenty of satisfaction derived from autonomous model-making, following pictorial schema, a number of crucial skills and features is formed, as if "by chance". Some of them are related to mathematical education. The most desirable characteristics, from the point of view of mathematical predispositions, are the following:

- combining reasoning with manual activities – implementing the principle of learning Maths with fingers;
- developing spatial imagination by targeted manipulation with modelled paper sheets,
- developing precision – working prerequisite,
- implementing a patient and consequential need to follow adopted rules of conduct, necessary to achieve the final effect,
- developing intuition related to geometric figures, transformations, and their simplest characteristics,
- preparing for creative problem solving and demonstrating elementary conventions employed, e.g. principles/rules: the final result is arrived at by solving intermediate problems; a task once started should be completed, etc.

On top of the above mentioned characteristics, other vital aspects include those relating to child's emotional development. His/her willingness to work, happiness with results, artistic experience associated with problem solving – they are all key, although, not always fully appreciated, elements of Maths learning (Pisarski, 1992, pp. 118-120).

4. Computer-based mathematical games. Computer educational programmes for preschool-age children comprise a highly attractive form of classes and develop various skills. The man objective of computer mathematical programmes is to teach children logical reasoning skills and the solving of selected problems in the area of mathematics. Mathematical computer programmes are sets of mini games and activities during which children enhance their skills, such as classifying, ordering objects according to certain features, counting up to 20. Above all, they significantly facilitate the process of figure and number recognition, counting skills, understanding of mathematical terms, adding and subtracting, exploring basic and derivative colours, shapes, directions, time sequences. With the application of varying games, fun logical activities, crosswords, riddles, rebuses, puzzles, animations, picture puzzles, poems, sons, games involving movement, educational colouring pages, rhyming expressions, competitions, original tasks and activities, and thanks to the adjustment of the level of activity to child's age or individual potential, the majority of said programmes develops perceptiveness, concentration, memory, logical thinking, the ability to associate sounds, and language competencies. They develop children's imagination and perception, rhythmic, movement and sensual abilities, eye-to-hand coordination, and a broadly-understood creativity. Oral commands are also of importance, for the child can learn to understand and perform exercises correspondingly. The diversity of games and plays, interesting graphic design, cartoon animations, music which preschoolers are so keen on, sound effects, and fun reader comments encourage children to act and deliver educational contents in an absorbing, children-friendly, and easy-to-memorize manner. Multimedia educational programmes for children are great fun to the youngest users, while – simultaneously – delivering preschool knowledge and supporting the course of preschool education. (Klim-Klimaszewska, 2010, pp. 255-256).

After a series of classes with the use of above quoted educational games, a mathematical skills test was retaken. The results obtained are demonstrated in Table 3.

Table 3. Children's mathematical skills test findings – Study II

No.	Analysed skill	% of children		
		A	**B**	**C**
1.	Describing location of objects, recognizing and using terms: on, under, next to, behind, in front of	65.2	34.8	-
2.	Telling right from left	34.8	65.2	-
3.	Directions/orientation on paper	34.8	65.2	-
4.	Recognizing shapes, naming geometrical figures: a circle, a square, a triangle, a rectangle.	100	-	-
5.	Grouping and classifying objects according to a given criterion	70	30	-
6.	Counting elements in a set, using terms: less, more, as many as	87	13	-
7.	Using numerals (cardinal and ordinal numbers)	43.5	56.5	-
8.	Counting of up to 10 objects	70	30	-
9.	Determining the result of adding/ subtracting up to 10	39	61	-
10.	Spotting regularities and capacity to continue them	52.2	47.8	-
11.	Naming sizes and lengths, using terms: big, bigger, the biggest, short, long, the same size, longer, shorter, the longest, the shortest	73.9	26.1	-
12.	Recognizing time sequences (day and night, seasons of the year, months)	52.1	47.9	-

Data presented in Table 3 show that in Study II, there were no children who would not complete the task or complete it incorrectly. The vast majority of the children (60.2%) performed every task correctly, whereas 39.8% of the children performed tasks partially correctly.

When comparing the results of both analyses, we can see that in Study II, the number of children who correctly completed all tasks increased by 45.3%. At the same time, the number of children who completed a task only in part decreased by 37.4%. The number of children who did not complete a task or completed it incorrectly equalled zero in Study II.

Conclusion

The main component affecting developmental opportunities of a child is his/her creative activity. The themes or subjects presented during classes becomes a stimulus for child's inner expression and allows him/her acquisition of new experiences and skills. Hence, child development may be promoted by a variety of situations encouraging one to take up various actions aiming at reality exploration with the application of different methods, arousing child's interest and involvement, and showing open-ended problems. Therefore, methods to be used when working with children are those associated with spontaneous and unrestrained activities, ones that will release their creativity, which include amongst other things – educational (didactic) games.

The effect of the application of didactic games is an increase in the level of children's mathematical education. The findings presented in the tables do not express the joy children experienced when participating in educational games. The children were contented and pleased, the games arouse their interest, encouraged them to overcome difficulties and acquire new terms. Competition or rivalry found in didactic games stimulated children to perform tasks correctly, to focus on winning and devote all their energy to perform well.

Educational or didactic games fulfil their functions only when they are adequately planned and conducted. Most importantly, they need to be pleasant for the children. Through the employment of educational games, we may definitely affect the development of mathematical skills in children.

If every teacher introduced the method of educational games into his teaching practice, children would be invigorated and excited to explore new mathematical notions. We may not forget that the most crucial is conscious and active children's participation. It may not be achieved in the absence of educational games. They play an underlying role in mathematical education, for it is vital that children take delight in the ability to solve problems using concrete examples, which makes classes more attractive. A well-organized, interestingly conducted game or didactic activity is of a great advantage to young minds. The teacher should be familiar with many didactic games, so as to choose those best meeting the needs and interests of his/her pupils. This is due to the fact that repetition develops fatigue and weariness, rather than activation.

However, there is a number of obstacles which may impede the correct implementation of educational games. Their use requires plenty of planning and considerations on the part of teachers, a lot of work and preparations, escaping the routine and a more comfortable (common) class scheme, and a continuous search for new ideas and solutions.

References

Bleher, F. N. (1952). *Gry dydaktyczne i pomoce do gier w przedszkolu* [Didactic games and game aids in preschool]. Bydgoszcz: PZWS.

Błanik, R. (1999), Zabawy w edukacji wczesnoszkolnej [Games in early-school education], *Życie Szkoły*, 2, 103-104, 137-138.

Filip J., & Rams T. (2000). *Dziecko w świecie matematyki* [Child in the world of Maths], Kraków: Impuls.

Gruszczyk-Kolczyńska E., & Zielińska E. (2004). *Wspomaganie rozwoju umysłowego czterolatków i pięciolatków* [Supporting mental development of four- and five-year olds]. Warszawa: WSiP.

Iwańska D. (2001). Zajęcia matematyczne (Maths classes), *Wychowanie w Przedszkolu*, 4, 227-229.

Kamecka E. (2004). Praca z sześciolatkiem... od A do Z. Z praktyki [Working with a six-year-old... from A to Z. From practice], *Wychowanie w Przedszkolu*, 6, 37-43

Kędzior-Niczyporuk E. (2003). *Wprowadzenie do pedagogiki zabawy* [Introduction into the pedagogy of fun]. Lublin: Klanza.

Klim-Klimaszewska A. (2010). *Pedagogika przedszkolna. Nowa podstawa programowa* [Preschool pedagogy. New core curriculum]. Warszawa: ERICA.

Kruszewski K. (2004). *Sztuka nauczania. Czynności nauczyciela* [The art of teaching. Teacher's activities]. Warszawa: PWN.

Łukasik L., & Cyran T. (2002). Gry i zabawy dydaktyczne [Educational games]. Życie Szkoły, 5, 307-312.

Nowak J. (2011). Dziecięce budowanie obrazu pojęciowego liczby [Children's construction of conceptual images of numbers], Wychowanie na co Dzień, 1-2, 28-31.

Okoń W. (1987). *Zabawa a rzeczywistość* [Games vs reality]. Warszawa: WSiP.

Pisarski M. (1992). *Matematyka dla naszych dzieci. Gry i zabawy rozwijające uzdolnienia matematyczne* [Mathematics for our children. Games and activities developing mathematical talents]. Warszawa: Eceri.

Rynek J. (2003). Gry i zabawy sześciolatków [Games for six-year-olds]. *Wychowanie w Przedszkolu*, 5, 545-547.

Skura M. (2009). Wyzwania edukacji matematycznej (Challenges of mathematical education), Bliżej Przedszkola, 12, 43-45.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 239 -249

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Developing Pre-service Mathematics Teachers' Metacognitive Thinking for Learning and Teaching with Mobile Technology

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Abstract: In the present study, we report the preparation of 24 pre-service teachers who were in their third academic year, majoring in teaching mathematics and computer science in the middle school, for using metacognition in their mathematical problem solving. We used different tools to collect data: The pre-service teachers' solutions' texts of carrying out activities on solving authentic real life mathematical problems that emphasize metacognitive processes, the pre-service teachers' texts for the design and preparation of such activities that encourage students' metacognitive processes, interviews with the pre-service teachers, the discussion texts in the social network sites and observations of the implementation of activities. To analyze the data, we used the constant comparison method. The research findings indicated that the participating pre-service teachers developed their metacognitive skills as learners at the beginning and then as teachers. This development as teachers included two aspects: activity design and activity implementation. In addition, we describe a preparation model that included different phases starting from the theoretical phase and ending in a reflection phase, where some parts of these phases are cyclic. We concluded that it is possible to educate pre-service teachers for metacognitive practices, as learners and as teachers. To succeed in this education, the pre-service teachers need to solve activities that emphasize metacognitive skills, to design such activities, to teach them, to discuss their practices, and to reflect on the whole sequence of metacognitive processes. Special attention was given to using mobile technology in solving authentic real life mathematical problems and to collaborative learning.

Keywords: Professional development, Preparation model, Pre-service teachers, Pre-service teachers preparation, Mathematics teachers, Metacognitive thinking

Introduction

Researchers pointed at the contribution of metacognition use on students' learning. For example, students who demonstrate metacognitive knowledge and skills perform better in their learning (Schoenfeld, 1992). In addition, researchers pointed that metacognition knowledge and skills could be developed by education (Schneider & Artelt, 2010). This implies that teachers colleges should prepare pre-service teachers to teach with emphasis on the use of metacognitive skills, if in learning or teaching. The present paper describes an experiment that intended to educate mathematics pre-service teachers for using metacognition in their problem solving, as learners, and in their instruction in the middle school, as teachers. The experiment was held for a full academic year with 24 pre-service teachers who were in their third study year, majoring in teaching mathematics and computer science in the middle school. Two of the authors were the pedagogical supervisors of these pre-

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

service teachers in the frame of practical training. The middle school students who were part of the experiment were selected from eighth and ninth grades according to the recommendations of their mathematics teachers who were also mentoring teachers for our pre-service teachers. In this experiment, we requested our pre-service teachers to use metacognitive processes for solving authentic real life mathematical problems in addition to encouraging their middle school students to do so. In the whole experiment, we depended on the work of Davidson and Steinberg (1998) with special emphasis on using mobile technologies in the solution strategies. In addition, special attention was given for collaborative learning among the learners. To encourage the use of metacognition in problem solving among our pre-service teachers and among the middle school students, we requested the pre-service teachers to work in social sites forums – specifically in the Edmodo social network, which was installed on the pre-service teachers' and the middle school students' mobile phones. The participating pre-service teachers utilized the social networking sites to discuss the use of metacognitive processes in problem solving. In addition, they utilized these social networking sites to lead the middle school students in their metacognitive processes through posing questions that would encourage these processes.

Literature Review

Researchers looked at metacognition as cognition about cognition or knowledge about knowledge (Flavell, 1976; Panaoura, Philippou & Christou, 2003). Flavell (1976) was the first to use the term 'metacognition' to refer to the individual's awareness, consideration and control of his or her own cognitive processes and strategies. Since then, a variety of definitions has been given to the term of metacognition. Du Toit and Kotze (2009) argue that the various definitions of metacognitive processes in the literature, including that of Schoenfeld (1992), emphasize the monitoring and regulation of cognitive processes. Moreover, Gavelek and Raphael (1985) argue that metacognition involves promoting effective understanding through adjusting the cognitive processes involved in the activity. Furthermore, Panaoura et al. (2003) say that it coordinates cognition, affecting it and, as a result, affecting students' academic success.

Researchers pointed out that metacognition is comprised of two different components connected to each other. Veenman et al. (2006) argue that the most common distinction in metacognition distinguishes between metacognitive knowledge and metacognitive skills. Flavell (1999) defines metacognitive knowledge as the knowledge or beliefs about the factors that act and interact to affect the course and outcome of cognitive enterprises. These factors include the person, the task and the strategy. The person factor concerns what a person believes about himself/herself and other people as cognitive processors. The task factor concerns the information about the object available to a person during a cognitive enterprise, where different tasks entail different mental operations. The strategy factor involves knowledge about strategies likely to be effective in achieving goals and their cognitive undertakings. On the other hand, metacognitive skills involve planning, monitoring, evaluating and regulating the processes leading to achieving goals.

In addition, researchers suggested ways to encourage students to use metacognitive processes (e.g., Spiller & Ferguson, 2011). Flavell (1979) emphasizes that metacognition improves with practice. Schoenfeld (1992) describes ways that students can practice monitoring and evaluating their performance on math problems. For example, pause frequently during problem solving to ask themselves questions such as “What am I doing right now?” Spiller and Ferguson (2011) say that if we want students to use metacognitive processes, we need to encourage them to consider the nature and sequence of their own thinking processes. Chauhan and Singh (2014) say that as students become more skilled at using metacognitive strategies, they become confident and more independent as learners. Moreover, researchers studied how students' knowledge influences their use of cognitive and metacognitive processes. Awawdeh-Shahbari, Daher and Raslan (2014) investigated the relationship between mathematical knowledge and cognitive and metacognitive processes exhibited by students from Grades 6, 7, and 8 who engaged in a set of model-eliciting activities in groups of 4-5 students each. The results of the study showed that the highest percent of cognitive processes and lowest percent of metacognitive processes occurred amongst the Grade 6 students, while the lowest percent of cognitive processes and highest percent of metacognitive processes occurred amongst the Grade 8 students. The Grade 6 students‟ metacognitive processes were more awareness than regulation and evaluation skills. Conversely, the Grade 7 and 8 students employed more regulation and evaluation processes.

In the present research, we wanted to educate mathematics pre-service teachers for using metacognitive processes, as learners and as teachers, through utilizing mobile technologies and collaborative learning.

Mobile Technology in Mathematics Education

Mobile technologies in general have been used in the mathematics classroom for more than a decade now. Advantages of using mobile technologies in education encourage teachers' use of these technologies, where various reasons encourage teachers to use them in their teaching (Daher & Baya'a, 2014; Ng & Nicholas, 2012). Ng and Nicholas (2012) examined the reasons that encourage teachers' use of mobile technologies. They reported that teachers are interested in mobile technologies for their professional development and because these technologies raise students' motivation to learn. In addition, these mobile technologies influence positively students" behavior and emotions. These positive influences of mobile technologies make us encourage our pre-service teachers to use them in their teaching. In the present research, we encouraged them to use the mobile technologies in their metacognitive experiences, especially in solving real life mathematical problems.

Research Rationale and Goals

Schneider and Artelt (2010) point that the importance of educational contexts for the development of metacognitive knowledge was first highlighted in the field of memory development. This was done in studies that focused on the development of children"s strategies in learning. These studies indicated that most of the memory and meta-memory development was not so much a product of education and practice rather than of age. It was the aim of the present research to develop educational contexts for the development of pre-service teachers' metacognitive knowledge and skills in solving, designing and implementing authentic mathematical problems with mobile technology when metacognitive skills are emphasized. To develop such context, our previous attempts for developing educational contexts and models for pre-service teachers' professional development in innovative practice (Daher & Baya'a, 2015) were taken into account. We took into consideration that the model should be detailed regarding its phases and the processes of each phase. We expected that such detailed model would help teacher educators plan and carry out professional development courses in the use of metacognition in learning and teaching for pre-service teachers. The description of this model would enrich the literature that lacks such a model.

Research Question

What are the phases of the preparation of mathematics pre-service teachers for integrating metacognition-based authentic mathematical activities that utilize mobile technology in their teaching?

Findings

In this section, we will describe the preparation model and its induced processes.

The preparation processes included several steps which aimed to gradually develop the awareness of the pre-service teachers to metacognitive thinking processes in solving authentic real life mathematical problems, and in designing and implementing activities that emphasize metacognitive processes among students. These steps involved theoretical preparation related to the topic of metacognition; designing activities based on metacognitive skills and the use of mobile devices that utilize proper midlets for solving authentic mathematical problems; implementing these activities by themselves and with middle school students; and, at the end, reflecting on and evaluating of the whole preparation process. We illustrate each step below.

Phase One: Theoretical Preparation for Metacognitive Thinking

In this phase, the pedagogical supervisors emphasized three major aspects of metacognitive thinking: definition of metacognitive thinking, the importance of metacognitive thinking in problem solving, and the assessment of metacognitive skills. This was done through the workshop sessions which accompanied the practical training. Each of the sub-phases is described below.

First sub-phase of phase one: Definition of metacognitive thinking

At this sub-phase, our goal was to engage the pre-service teachers in discussing the various definitions of metacognitive thinking as presented in the literature. For this purpose, a set of definitions were presented and discussed with the pre-service teachers.

Discussing these definitions, the pre-service teachers became aware that studies vary in their definitions of metacognitive thinking, where these definitions are based on psychological or educational approaches. Despite this difference, they are compatible and conform to the characteristics of metacognitive thinking. In line with our objectives, the educational approach of metacognitive thinking was adopted. The pre-service teachers discussed the educationally-approached definitions, where some of the definitions were: “Metacognition refers to one"s knowledge concerning one"s own cognitive processes or anything related to them, e.g., the learning-relevant properties of information or data. For example, I am engaging in metacognition if I notice that I am having more trouble learning A than B; if it strikes me that I should double check C before accepting it as fact” (Flavell, 1976, p. 232), "Metacognition is individuals" awareness and control of their cognitive processes in learning" (Swanson and Torhan,1996), "Metacognition is form of executive control involving monitoring and self-regulation" (McLeod, 1997; Schneider & Lockl, 2002) and "Metacognition is thinking of one self-reflection, which allows him control of his thoughts and self-rebuilt, also plays an important role in learning and problem solving" (Guss & Wiley, 2007).

Second sub-phase of phase one: Using metacognitive process in solving authentic real life mathematical problems

At the beginning, the pre-service teachers were engaged in solving the following problem: “A computer engineer from a village in the suburbs was hired to work for a Hi-tech company in the city. We want to help the computer engineer to find the most efficient way to get to work. He must make the decision within a month”.

To encourage the pre-service teachers to use metacognitive skills, we requested them to utilize the theoretical framework developed by Davidson and Steinberg (1998). In addition we encouraged them to utilize mobile tools in their solutions. The main metacognitive skills that we suggested were: Encoding and representation of the givens before the beginning of the solution processes; problem decomposition; planning; selecting and implementing strategies to reach the goal (efficient solution of the problem); monitoring of the plan (through the solution process to reach the goal); evaluating the solutions; searching for other solutions; evaluating the strategies used; and searching for other strategies that could improve and make the solution process more effective. Doing that, we discussed with the pre-service teachers the use of mobile technologies as tools that assist the use of metacognition in solving authentic mathematical problems.

Third sub-phase of phase one: Measurement of metacognition

We introduced the pre-service teachers to several suggested methods for measuring metacognitive thinking, including suggested questionnaires. The participating pre-service teachers came to know that the measurement of metacognitive thinking varies according to the purpose of the measurement. Researchers suggested methods for measuring metacognitive thinking for the knowledge component as well as for the skills component. At the same time, they suggested to measure metacognition at the personal level, as well as at the group level.

To evaluate the metacognitive knowledge we should consider three aspects: Person - where the individual's general abilities to learn and to handle information and self-knowledge about his or her learning process are identified. Task - where the individual's knowledge of the nature of the problem is assessed. Strategy - where the strategies available to the individual to solve the task successfully are identified and used flexibly.

To evaluate the metacognitive skills we should consider the skills: Planning - where actions are defined and arranged, the direction of thinking is determined, strategy is chosen, obstacles and methods to overcome them are identified; monitoring - where the problem solution process is monitored, also the progress towards the goal and errors are detected and addressed; evaluating – where the extent to which the goal or expected outcomes are achieved, performance assessment, and effectiveness of the plan and strategy.

Fourth sub-phase of phase one: Discussion of research in the field of metacognition

The pre-service teachers were requested afterwards to work on research papers in the field of metacognition. They did that in pairs or triples. When the pre-service teachers presented their readings, many of the ideas and terminology in the field of metacognition were discussed. At this stage, several terms and concepts related to metacognition were explored and investigated through various examples. After the presentations, the reports on the articles were uploaded to Moodle, for all the participating pre-service teachers to read.

Phase Two: Designing Activities that Would Encourage Metacognitive Thinking

At the first phase, the pre-service teachers had theoretical background and knowledge of metacognition that we expected would be sufficient for them to prepare authentic real life mathematical problems that encourage the use of metacognitive skills in a mobile environment. Therefore, the pedagogic supervisors requested the pre-service teachers to design such activities. Each pre-service teacher was requested to choose a midlet (a mobile information device applet), learn this midlet, and design an activity for solving an authentic mathematical problem that would raise the need for the use of the midlet; i.e. the middle school student could select the midlet in one solution strategy (a metacognitive process related to the strategy selection metacognitive skill). For example, one pre-service teacher chose a midlet from „Science Journal App" as a tool for carrying out the following activity:

The school neighbors wrote a complaint to the village police claiming that the school bell makes a high noise that disturbs them. The school administration appointed a science teacher and a group of students to examine the neighbors claim, and adjust the school bell speakers so the sound would not exceed the allowed level by law. Help the students accomplish their task.
The pre-service teacher suggested the following metacognitive processes to help the students perform their task:
<u>Encoding of the givens</u>: Searching for the noise law in the internet, which determines the level of noise allowed in the neighbourhoods.
<u>Representation of the givens</u>: Getting the village map and locating the school and the complaining neighbours. Drawing a sketch for these locations with distances.
<u>Decomposition of the problem</u>: Deciding on locations with different distances from the school to measure the bell sound at each one of them.
<u>Planning</u>: (1) Searching for a strategy to measure the sound, then measure the sound at the different locations while the bell is on. (2) Comparing the sound levels with the sound allowed by the law. (3) Adjusting the bell sound so that the closest neighbour would not get a sound exceeding the sound level allowed.
<u>Selecting and implementing strategy</u>: Because of the mobile and real life situated problem, the students would search in their mobile phones for a suitable application. They would find one, such as 'Science Journal App' for measuring sound level.
<u>Monitoring of the plan</u>: The students are advised to repeat their measures several times to make sure that they will get accurate results.
<u>Evaluating the solutions</u>: The students would get to the locations of the complaining neighbours, and measure the bell sound after they adjusted it, to make sure they solved the problem by checking with the neighbours if they are still complaining about the noise.
The pre-service teacher attached to this activity the following teaching materials which she prepared: Description of the mobile application, link to the internet site of the mobile application, and her reflection on the use of this mobile application. These materials were required from each pre-service teacher, and were uploaded to a Google internet site that was constructed by the pre-service teacher.

Phase Three: Implementing Activities that Would Encourage Metacognitive Thinking

First sub-phase of phase three: Discussing the implementation of the activities in Edmodo forums

In the following phase, the pre-service teachers were requested to form groups of 5-6 pre-service teachers each, in order to implement some of the prepared metacognitive activities with the students in the training middle school. To ensure effective implementations, each group of pre-service teachers was advised to open two Edmodo groups to discuss the implementation of the activities. The first Edmodo group included only the group of pre-service teachers working together, while the second group included the group of pre-service teachers together with the group of middle school students with whom the activity will be implemented.

To ensure the effectivity of the Edmodo forums discussions, the pre-service teachers were advised to ask proper questions that would encourage metacognitive thinking. We used Schoenfeld"s (in Davidson and Sternberg, 1998) method to teach monitoring and evaluating the performance regarding mathematics problem solving. For example, the pre-service teachers could ask “What are we/you doing right now?”, “Could we/you do what you are doing in a more effective way?”, “What other strategies are available that could better my work?” The pre-service teachers" Edmodo group also discussed the implementation of the task and obstacles that could be faced with students.

Second sub-phase of phase three: Carrying out the same collaborative activity by each group of pre-service teachers

The pre-service teachers were advised also to carry out a task, suggested by the supervisors, by themselves and upload to the Edmodo group teaching materials and suggestions for improving the interactions with their students. For example, they described various strategies for the performance of the measurements that would be taken in the activity. At the same time, they suggested questions that would encourage students to use metacognitive skills. The pedagogic supervisors of the pre-service teachers were part of the two forums and contributed to them only when necessary to encourage the metacognitive processes by the pre-service teachers and the middle school students.

The task that the pedagogical supervisors suggested to the pre-service teachers was:
Tiling task: A landlord asks you to calculate the costs of tiling the wall that includes the entrance to his house. How can you help him?

At the beginning, the pre-service teachers discussed the task in their Edmodo group, suggesting how metacognitive processes could be utilized in it. Afterwards, the pre-service teachers carried out the task by themselves using two midlets: „Photo Ruler" and „Smart Measure". Throughout the performance of the task by the pre-service teachers, they discussed in the Edmodo forum the obstacles they faced and suggested strategies to overcome them. The Photo Ruler gave relative non-realistic measurements, but the Smart Measure helped in converting the proportional measurements to realistic ones, when performing measurements from a specific location.

Third sub-phase of phase three: Carrying out the same activity with middle school students

The next sub-phase was to implement the same tiling activity by the pre-service teachers with students in the training middle school. Following are examples of the discussions held at this sub-phase between the pre-service teachers and the students in the Edmodo forum.

Examples from the encoding:

PST (Pre-Service Teacher): “Do you need more data to carry out the task? If yes, discuss ways for getting these data.”
S (Student): “We need to find the measurements of the tile that the landlord chose to tile with.”
S: “My uncle works in tiling and has a shop of tiles. I will ask him to give me tiles" sizes and the cost of doing the tiling.”
S: “How do we choose a tile? It is not given in the task.”
PST: “You can agree among you on one type and assume the same size for all the tiles.”

Examples from the representation of the problem:

PST: “Discuss together a good way to represent the problem.”
S: “We could ask the landlord if he has the architectural sketch of the house.”
PST: “What if the landlord does not have it?”
S: “We could take a picture of the entrance wall.”
PST: “Does this give you measurements of the wall, windows and door?”
S: “We can print the picture, or draw a sketch, and do measurements of the wall by ourselves, and write it on the sketch.”

Examples from the strategy selection:

PST: “How would you do the measurements?”
S: “We can use the meter instrument.”
PST: “what about measuring the height of the wall?”
S: “We can use a long rope, but we need to go up to the roof.”
PST: “Do you think this is possible and realistic. Discuss this strategy with the group. Find alternative strategies and discuss which one could be realistic, feasible and easy to implement.”

The last discussion continued until they reached an agreement on using the Photo Ruler and Smart Measure. Afterwards, the pre-service teachers accompanied their students in practicing the midlets. Doing that, the pre-service teachers uploaded user guides for the two midlets to the Edmodo forum in which the students were participants. They posed questions in the forum and directed the students to answer the questions in order to discuss their ideas and thoughts regarding the implementation of the activity. The students were also encouraged to upload their work in the field, such as pictures taken of the house entrance, screenshots of their measurements using the mobile midlets, and any other material related to their solution processes.
Some students worked in two groups and provided two solutions for the same entrance wall, therefore, the pre-service teachers directed them to evaluate their solutions and compare between them. Throughout carrying out the activity, the pre-service teachers kept asking the students to monitor their solutions and make sure that they are advancing towards the goal.

Fourth sub-phase of phase three: Carrying out different collaborative activity by each group of pre-service teachers

By the end of the implementation process of the first task which was the same for all the groups of pre-service teachers, each pre-service teacher had already completed the design of the personal mobile-based and metacognition-based authentic mathematical activity. This design prepared the ground for the second collaborative task to be carried out by the groups of pre-service teachers. Each group was requested to select the best activity among those prepared by the members of the group. This was done through discussion in the pre-service teachers‟ Edmodo group. The discussion involved the two factors of the activity: its utilization of metacognitive processes and of mobile midlets.

After the selection of the best activity for each group, each group of pre-service teachers implemented the chosen collaborative activity with the students. Throughout and after the implementation, they reflected on it in their forums.

Fifth sub-phase of phase three: Reflecting on the implementation process

The pre-service teachers reflected in their Edmodo forum on the obstacles they faced throughout the implementation of the first task with their students. These reflections were taken into consideration in the planning and carrying out of the second task. They reflected again on the second task, but this time the reflection was done together with their students.

At the end, all the pre-service teachers evaluated the whole preparation process in the general forum - the forum for all the pre-service teachers.

Phase Four: Evaluation of the Whole Preparation Process

When evaluating the preparation process, the pre-service teachers mentioned the following aspects:

Edmodo as a social networking site for collaborative learning

The pre-service teachers were impressed with the way Edmodo allowed them to organize, communicate and upload materials for their use, and the collaborative use of their students.

Following are some statements of the pre-service teachers: “Our experience with Edmodo was fantastic. We were able to discuss, follow up and monitor our preparation of the task and the students‟ solution process”, “The experiment was interesting and distinctive. We have benefited greatly from Edmodo for it enabled interactive collaborative mobile learning”.

Development of the thinking processes

The pre-service teachers reported that they started thinking differently. In addition, they pointed out that the experience expanded their horizons.

Following are some statements of the pre-service teachers: “We are now different people. We think about problems in a different way. We are now trying to organize the givens in any problem we face, and we think about the steps and strategies of the solution process”, “We grasped through the experiment many scientific and educational concepts and processes”.

Expose to mobile applications

The pre-service teachers valued that they recognized new mobile applications. Following are some statements of the pre-service teachers: “We have learned about many educational and collaborative mobile applications that can be integrated into math lessons", “The experiment broadened our horizons, and revealed us to many authentic problems that could be solved with mobile applications”.

Obstacles the pre-service teachers faced through the experiment

The pre-service teachers reported some of the obstacles they encountered during the preparation process in general. They described the process in its early stages as relatively difficult. They stated that they needed more practice in metacognitive thinking in order to lead their students in using this thinking, especially in implementing the first collaborative activity. However, they got more ability over time, particularly when addressing the second collaborative activity.

Following are some statements of the pre-service teachers: “In the first collaborative activity, our work was slow and uncertain, but with the beginning of the second collaborative activity, we were much better in metacognition and carried out the activity emphasizing metacognitive skills”.

Obstacles the pre-service teachers faced with the middle school students

The pre-service teachers reported that they faced different obstacles in carrying out the activities with their middle school students. These obstacles were due to the difficulties which the students confronted in Edmodo as a new learning platform. They also confronted difficulties with the mobile applications, and with the authentic activities that the students were not used to.
Following are some statements of the pre-service teachers: “The students were introduced to new technological pedagogical models that they were not used to. So, they had technical difficulties at the beginning of the experiment, especially with the downloading and operating the mobile applications in real life situations”, “After presenting the task to the students, some ambiguity was observed, perhaps because this type of questions, activities and learning in Edmodo was new to them.”

Overcoming the difficulties with successive workshops

The pre-service teachers noted that the successive workshops conducted by the pedagogical supervisors, through which questions, challenges and solutions were raised and discussed, contributed to overcoming the above obstacles. The forum in Edmodo, which included all the pre-service teachers and the pedagogical supervisors, and the collaborative work among the pre-service teachers, contributed to overcoming and absorbing the challenges, motivated them and raised their confidence. This motivation and confidence affected positively the students in the middle school and raised their collaboration and commitment.

Following are some statements of the pre-service teachers: “Parallel to the guidance of the pedagogical supervisors and the collaboration among the pre-service teachers, we began to notice students" interaction and engagement”, “The students were enthusiastic about the activities and praised the unique experience they had in these unique and authentic activities.”

Opinions and suggestions for improvement

In addition to the previous reports, the pre-service teachers emphasized the importance of allowing more time to the implementation of the activities with the middle school students. They also pointed to the importance of working in small groups (3-4 pre-service teachers). Furthermore, they also suggested exposing the participants in the experiment to more tasks from various fields, and not only mathematics, to get deeper understanding of the metacognitive thinking.

Following are some statements of the pre-service teachers: “There is a need to present more tasks from various fields to strengthen our metacognitive thinking in order to be more competent in this kind of thinking”, “We must allocate sufficient time for each activity with the students to emphasize the various metacognitive processes”, “The groups should be constituted of 3-4 pre-service teachers. When more persons are involved, not all of them will be active.”

Discussion

The present paper describes a model, together with its induced processes, for educating mathematics pre-service teachers in using metacognitive skills in their solving, with the assistance of mobile technologies, of authentic real life mathematical problems, in addition to designing and implementing activities that would encourage students‟ metacognitive thinking. This model is part of our other models of preparing mathematics teachers to teach mathematics, with the assistance of technology, and which emphasize specific aspects of mathematical thinking, as high order thinking (Daher & Baya'a, 2015).

Our experience in educating the pre-service teachers in one academic year proved that this education could be successful on condition that it follows a sequence of phases in the actual preparation: Theoretical preparation for metacognitive thinking, designing activities that would encourage metacognitive thinking, and implementing activities that would encourage metacognitive thinking, by the pre-service teachers themselves then with their students. These phases include sub-phases that take care of the various aspects of the phase. The complementary of the theoretical and practical aspects of the preparation plan, as well as the sequence of phases are essential and can help and lead the pre-service teachers to develop professionally in applying metacognitive skills in their teaching. This importance of the sequence of phases in the pre-service teachers' preparation has been emphasized in the literature. For example Daher and Baya‟a (2015) suggest a sequence of phases to prepare mathematics pre-service teachers for integrating high order thinking skills in their teaching. The preparation model suggested in this paper is different from the one suggested in the previous study in the extent of the theoretical part. This emphasis may indicate the complexity of the metacognition construct, which makes it necessary to discuss deeply its characteristics depending on the literature.

The success of the preparation is also conditioned by its engagement with the theoretical as well as the practical preparation. This connection of research and practice has been long considered as a way to improve teachers' practices (Lerman, 1990), i.e. to develop professionally, here in utilizing metacognition in the preparation and implementation of mobile-based mathematics activities. We utilized this connection of research and practice in previous preparation models of mathematics pre-service teachers, but here it has a special value because of the complexity of the metacognition construct, which makes it necessary to attempt scaffolding the meanings of metacognition for learners and teachers (e.g. An, & Cao, 2014). The literature helped clarify the meaning of this construct for the pre-service teachers.

Conclusions and Recommendations

Metacognition meanings are not simple to internalize, so preparation is required to ensure that learners and teachers use the metacognitive knowledge and skills appropriately during their learning and teaching. In the present research, we proposed a model, together with its induced processes, for the preparation of pre-service teachers to utilize metacognition in the preparation and implementation of mobile-based mathematics activities. Further research is needed to study the various aspects of pre-service teachers‟ preparation to integrate metacognition in their teaching, for example whether there is difference among these pre-service teachers‟ due to their content knowledge or pedagogical knowledge. Another issue is the professional development of in-service mathematics teachers in using metacognition in their teaching, and whether the same sequence of phases is also suitable for them. A third issue is mathematics teachers‟ beliefs about using metacognition in their teaching, and how these beliefs are affected as a result of their preparation to use metacognition in their teaching.

References

An, Y.J., & Cao, L. (2014). Examining the effects of metacognitive scaffolding on students' design problem solving and metacognitive skills in an online environment. *Journal of Online Learning and Teaching, 10*(4), 552.

Awawdeh-Shahbari, J., Daher, W. & Raslan, S. (2014). Mathematical knowledge and the cognitive and metacognitive processes emerged in model-eliciting activities. *International Journal of New Trends in Education and Their Implications, 5* (2), 209-2019.

Chauhan, A., & Singh, N. (2014). Metacognition: A conceptual framework. *International Journal of Education and Psychological Research (IJEPR), 3* (3), 21-22.

Cox. M. T. (2005). Metacognition in computation: A selected research review. *Artificial Intelligence, 169*(2), 104-141.

Daher, W., & Baya'a, N. (2014). Integrating HOTS Activities with GeoGebra in Pre-Service Teachers" Preparation. International Journal of Educational and Pedagogical Sciences Vol:9, No:7, 2441-2444.

Daher, W., & Baya'a, N. (2015). Integrating HOTS Activities with Geogebra in Pre-Service Teachers' Preparation. *International Scholarly and Scientific Research & Innovation 9*(7), 2441-2444.

Davidson, J. E., & Sternberg, R. J. (1998). Smart problem solving: How metacognition helps. In D. J. Hacker, J. Dunlosky, & A. C. Graesser (Eds.), *The educational psychology series-Metacognition in educational theory and practice* (pp. 47-68). Mahwah, NJ: Lawrence Erlbaum Associates.

Du Toit, S. & Kotze, G. (2009). Metacognitive strategies in the teaching and learning of mathematics. *Pythagoras, 70*, 57–67.

Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. B. Resnick (Ed.), *The nature of intelligence* (pp.231-236). Hillsdale, NJ: Erlbaum.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive developmental inquiry. American Psychologist, 34(10), 906-911.

Flavell, J. (1999). Cognitive development: children"s knowledge about the mind. *Annual review of psychology, 50*, 21-45.

Gavelek, J. R., Raphael, T. E. (1985), Metacognition, instruction, and questioning, In D. L. Forrest-Pressley, G. E. MacKinnon, T.G. Waller (Eds.), *Metacognition, cognition, and human performance* (Vol. II, pp. 103- 132), Orlando: Academic Press.

Guss, C., and Wiley, B. (2007). Metacognition of problem solving strategies in Brazil, India, and the United States. *Journal of Cognition and Culture, 7*, 1 – 25.

Hurme, T.-R., Palonen, T. and Järvelä, S. 2006. Metacognition in joint discussions: an analysis of the patterns of interaction and the metacognitive content of the net worked discussions in mathematics. *Metacognition and Learning, 1*, 181–200.

Lerman, S. (1990). The role of research in the practice of mathematics education. *For the Learning of Mathematics, 10*(2), 25–28.

Martinez, M. E. (2006). What is metacognition? Phi Delta Kappan, 696-699.

McLeod, L. (1997). Young children and metacognition: Do we know what they know they know? And if so, what do we do about it? *Australian Journal of Early Childhood, 22*(2), 6-11.

Ng, W. & Nicholas, H. (2012). A framework for sustainable mobile learning in schools. *British Journal of Educational Technology, 43*(1), 1-21.

Panaoura, A., & Panaoura, P. (2006), Cognitive and metacocognitive performance on mathematics, In J. Novotná, H. Moraová, M. Krátká, & N. Stehlíková (Eds.), *Proceedings 30th conference of the Int J Res Educ Sci 303 international group for the psychology of mathematics education*, vol. 4, (pp. 313-320), Prague, Czech Republic: PME

Panaoura, A., Philippou, G., & Christou, C. (2003). *Young pupils' metacognitive ability in mathematics*. Paper presented at the Third Conference of the European Society for Research in Mathematics Education.

Schneider, W. & Lockl, K. (2002). The development of metacognitive knowledge in children and adolescents. In Perfect, T. & Schwartz, B. (Eds.), *Applied metacognition*. Cambridge, UK: Cambridge University Press.

Schneider, W., & Artelt, C. (2010). Metacognition and mathematics education. *ZDM - The International Journal on Mathematics Education, 42*(2), 149-161.

Schoenfeld, H. (1992). Learning to think mathematically: problem solving, metacognition and sense making in mathematics. In D. A. Grouws (Ed), *Handbook of research on mathematics teaching and learning* (pp. 334-368). New York: McMillan.

Spiller, D., & Ferguson, P.B. (2011). *Teaching strategies to promote the development of students' learning skills*. Hamilton, New Zealand: Teaching Development Unit.

Swanson, H. & Torhan, M. (1996). Learning disabled and average readers‟ working memory and comprehension: does metacognition play a role? *British Journal of Educational Psychology, 66* (3), 333-355.

Veenman, M.V.J., Van Hout-Wolters, B.H.A.M, & Afflerbach, P. (2006). Metacognition and Learning: Conceptual and Methodological Considerations. *Metacognition and Learning, 1*, 3-14.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 250 - 260

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Laboratory Activities to Develop the Geometric Reasoning

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Abstract: A set of activities designed to foster geometric thought of students in the 2nd grade of junior High School (8th grade of elementary school in Brazil) is presented here. The activities were proposed to students of a public school. The learning was supported by teaching resources as Tangram, Geoboard and Bending. The activities, interdisciplinary, realistic and playful, were carried out in the Laboratory for the Teaching of Mathematics. The activities were performed in groups organized in such a way to enhance the interaction between students of different levels of knowledge. A test to check the van Hiele level of students was applied before and afterwards. The evaluations of the results of the tests reveal advances in the van Hiele level. The proposal applied to an experimental group provided an environment conducive to meaningful learning. It must be pointed that it also increased students confidence and stimulated them to develop continuity for the acquisition of new knowledge.

Keywords: Mathematical education, Van Hiele theory, Geometry, Meaningful learning

Introduction

This research deals with teaching Geometry in Elementary School. It follows the learning of Mathematics of students of the 8th grade along a school year. Activities were designed to foster the development of geometric thinking to aid the students to progress to higher levels of reasoning according to the Van Hiele Theory of Development of Geometric Thought (Nasser, 1992).

The activities were tested in a school of the public network of the Municipality of Macaé, in the State of Rio de Janeiro, Brazil. They were supported by concrete didactic resources and play activities, in interdisciplinary contexts. They were developed in the Mathematics Laboratory (Lorenzatto, 2009) and articulated the curricular contents of Mathematics with the daily situations of the student reality. Topics of study defined following Tomaz & David (2015) and Skovsmose (1994) principles of exploring everyday classroom situations were addressed in such a way as to allow for interdisciplinarity and interaction with the diversified realities of the students.

In the next section the theoretical foundations of the adopted approach, based on Ausubel (1961) Meaningful Learning Model and van Hiele (1957) Geometric Learning Levels Model, are presented. In Section 3, the teaching proposal is developed, with the presentation of features of the teaching in a Laboratory and of the evaluation tool applied. In Section 4 the activities are presented. In Section 5, the results obtained are analyzed.

Meaningful Learning and the Van Hiele Levels

The activities were structured with a main aim of ensuring meaningful learning (Ausubel, 1961). The Meaning Learning Model (Ausubel, 1961) starts from a critique of mechanical teaching that does not generate meaning and results that the student quickly forgets the information received. The model recognizes previous knowledge as the most important variable for meaningful learning, even though, in some cases, previous information may

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block learning. The spontaneously acquired knowledge is better assimilated. Mechanical learning makes the information received volatile. Later, the lack of such information, which should serve as a foundation for other concepts to be constructed, becomes a gap and makes the student's cognitive advances impossible.

Ausubel argues that meaningful reception encompasses the acquisition of new meanings from a mechanism or material potentially meaningful to the student. The new information acquired changes the old ones, by a reorganization of concepts. In his model, the acquisition of new knowledge depends on three elements: prior knowledge, subsumers and anchor ideas.

The material used for the development of new learning must be articulated with the needs and be appropriate to the objectives that one wishes to achieve. The learner must have considerable "anchoring ideas" that allow associations to be made to the new material. The confrontation of existing ideas with new information allows the construction of true meanings.

Besides, the student must be prepared to receive new information using anchor ideas to produce meanings. This needs developing subsumers. The often monotonous classroom should be renewed through teaching methods that enable discovery. The teacher must become a facilitator and mediator of the learning process, the one that provides situations, guides and encourages the student, who is the active subject of her learning. Teacher and student share the spaces, each one performing a function and both learning and teaching from their experiences.

Three types of meaningful learning must be considered: representational learning, the most elementary, in which the symbols are concrete elements, without any meaning beyond the univocal relation between object and event; conceptual learning, marked by the presence of regularities perceived in events or objects, which begin to be represented by a linguistic symbol, the individual no longer needing an event or object to give meaning to the symbol; and propositional learning in which the meaning of the new information is expressed by a proposition. This has as prerequisite the two types of previous learning.

These successive levels of learning lead us to van Hiele's (1986) model. This model is also based on an evolution of student's ability of learning each content. As in the model of meaningful learning, the van Hiele levels model also emphasizes the importance of respecting order and not skipping stages in teaching.
Van Hiele schematically divides the geometrical thought in five levels.

Level 1: Recognition

Students identify the figures visually by their overall appearance. They recognize, describe, compare, and classify them through their forms, but do not identify properties. At this level the individual can learn a geometric vocabulary, identify forms, and reproduce specific objects, but the thinking is based on visual considerations. This is representational learning.

Level 2: Analysis

Students begin to analyze and discern the characteristics of the figures by comparison and learn the symbology appropriate to describe them, but can not correlate figures or properties. "Properties are used to conceptualize classes of configurations" (Crowley, 1987), what enables to conceptual learning. Nevertheless reasoning is still based on informal analysis from observation and experience, what is typical of representational learning.

Level 3: Abstraction

Students at this level "are able to deduce properties of a figure and recognize classes of figures."(Crowley, 1987), but they still do not understand the meaning of a deduction or the role of axioms. "Students are able to follow formal demonstrations, but they do not see how one can alter the logical order or how one can build proof from different or unfamiliar premises."(Crowley, 1987). As students establish a logical ordering of figure properties by means of short deduction sequences and understand the correlations between the figures, they are able to conceptual learning.

Level 4: Deduction

Students begin to develop longer sequences of statements and understand the significance of deduction, the role of axioms, theorems, and proofs. The person at this level "... sees the possibility of developing a demonstration in more than one way; comprises the interaction of necessary and sufficient conditions; is capable of making distinctions between an affirmation and its reciprocal "(Crowley, 1987). The realization of conjectures and initiated efforts is spontaneous. A student at this level can build evidence, not just memorize it. She is then able to propositional learning.

Level 5: Rigor

At this level, "geometry is seen as an abstract plane" (Crowley, 1987). Students have the ability to understand formal demonstrations. They are able to understand axioms even in the absence of concrete models. They are in a full propositional level where they feel the need of rigor.

The Van Hiele Model leads the student to the level of visualization of a geometric concept, then to the level of analysis, then to that of logical ordering, further to the level of deduction, and finally to the level of rigor of conceptualization. At this point, the student becomes able to understand and fully relate abstract concepts.
Four important characteristics of the levels are highlighted by de Villiers (1987):
• Fixed order: The order in which students progress respects hierarchical levels. A student who is at level n> 1 passed an earlier level, n-1. It is presumed that for a student to assimilate the contents of a next level must master the previous level.
• Adjacency: At each level of thought, what was intrinsic at the previous level becomes extrinsic at the current level. Objects from an earlier level become objects of study at a later level.
• Distinction: Each level has its own linguistic characteristics and is interconnected in a particular way through them. Nevertheless, no sudden advance from one level to another should be expected and many intermediate cases, where the individual advances to one level and subsequently returns to the previous level may occur.
• Separation: Two people with reasoning on different levels can not understand each other.
Interest in the contributions of this model has attracted the attention of many mathematical education professionals. It involves two components: the description of the different types of geometric reasoning of the students throughout their formation and a description of how a teacher can organize the activity in their classes so that students can reach a higher level of reasoning.
A sequence of phases to organize the teaching according to the Van Hiele model, presented by Jaime and (1993); Fouz & De Donosti (2005) and Vargas & Araya (2013), drives meaningful learning.

Phase 1: Information / interrogation

The teacher identifies the previous knowledge that the students have about the subject. Teachers and students make observations and raise important questions. Students should be informed about the new field of study that will be initiated, the types of problems they will be confronted, the methods and materials that will be used.

Phase 2: Guided action

The teaching is directed through concrete activities, which respect a didactic sequence. Students should be encouraged to discover, understand, assimilate, and apply ideas, concepts, properties, and relationships. The teacher should guide problem solving when necessary.

Phase 3: Explanation

This phase is based on previous experiences, students should be able to express through oral or written language the results obtained from their experiences and argue about these with the teacher and other students. For this she should be inserted by the teacher in the appropriate vocabulary.

Phase 4: Free Orientation

Students use their knowledge to solve different problems. The teacher should limit help and propose problems that promote the discovery of new relationships and properties and that may allow different solutions or none at all. With this, the student acquires experience.

Phase 5: Integration

Students review and synthesize what they have learned in order to form an overview and a new internal network of learned knowledge. The teacher can offer recovery activities for students who have some shortcomings in acquiring geometric knowledge.
By the end of the fifth phase, students are ready to progress. A new reasoning domain replaces the old one.
In phases 1 and 2, the need of concrete objects and situations to conduct explorations and investigations chracterizes representational learning. In phase 3, the symbols have meanings, a specific language begins to be acquired and improved what would be conceptual learning. Finally, phases 4 and 5 involve propositional learning.

There is some difficulty in placing certain students at a specific level. There may be individuals in transition from one level to another. This may correspond to subsumers not integrated with the prior information. Perhaps the previous indicators are not well anchored, they may have unscientific meaning, a different concept than the expected and correct one has been created, what is impeding the progression in levels.

The Work in the Laboratory of Mathematics Learning

To produce improvements in student learning, we must plan, design, and propose tasks. The two theories start from concrete, so the activities carried out in the Laboratory are supposed to help in the assimilation of new knowledge and consequently in the promotion of levels.

Students in a class may show different levels of geometric thought. This suggests that the student be treated individually. Content management should be organized in a way that enables students at different levels to advance to higher levels.The idea of implementing diversified didactic strategies gives the teaching subsidies to attract students' attention and motivation. In the Laboratory the teaching materials are selected, adapted and created according to each context in which it will be inserted, and according to the objectives previously established.

The Laboratory of Mathematics Learning (LML) is a space for the collective, collaborative and cooperative construction of mathematical knowledge. It uses didactic resources that have the function of enhancing the exploration of contents, enriching the teaching activities and making the learning process more pleasant and effective.

The LML is a challenge for both, teacher and students. Classes in the Laboratory require the teacher to have a precise and structured plan, everything must be tested. The LML modifies the behavior of the teacher, which becomes a mediator of learning. It modifies also the behavior of the students themselves, as the explorations carried out are surprising and demand immediate responses.

The class had 38 students in the 8^{th} grade, with ages varying from 13 to 17. This level was chosen because it is at this stage that geometrical questions of daily life awaken students' interest in a natural and spontaneous way, enabling the exploration of situations that develop the capacity to argue and construct demonstrations. Thus, in an organized way, the teaching of Geometry can help the students to develop the reasoning to understand, describe, and represent the multiple situations of their world.As an initial feature, the class is agitated and unmotivated to learn the discipline. Most students, when questioned, declare that they “do not like math”.

Method

First, a pre-test, based on van Hiele's Theory, was prepared. Two classes performed the pre-test, the first with the 38 students in the experimental group and the second with 37 students, as a control group. This controller class received a traditional treatment of a Mathematics class of the school: oral presentation and textbook exercises.The pre-test included 19 objective and discursive questions addressing from the identification of forms to the more rigorous thought structuring.Using the results of the pre-test, the students were classified according to the theory of van Hiele. For the individual evaluation, the questions were approximately arranged in increasing order of difficulty, in such a way that students in each level would feel able to answer the questions until a certain point. This facilitated the analysis of the individual results.

Identifying the transition from one level of development to another is quite complex. The student can face some questions in a given level, but in a certain moment to return to an earlier level. We cannot rule out also situations of errors and accidental hits.

The questions were divided into three groups: 1) questions 1, 2, 4 and 5; 2) questions 3, 6, 7 an 11; 3) questions 8, 9, 10, 12, 13, 14, 15, 16, 17 and 18; 4) question 19.

Each item required the student to use their knowledge, from the teaching of content or experience acquired at some previous stage. Items 1, 2, 4 and 5 were designed to inform about this previous knowledge, which might affect the ability to solve the other questions. The students had to recognize figures by their overall appearance and identify their names or features associated with such names. Students in level I would be able to answer these items.

Items 3, 6, 7, 11 required the student to analyze properties of the geometric figures, but these did not directly relate the figures or properties to each other. These questions allowed the student to demonstrate the mastery of language and nomenclature corresponding to level II.

Items 8, 9, 10, 12, 13, 14, 15, 16, 17 and18 were designed to hint about entrance on level 3. They allowed to relate the figures to each other and to properties. They enabled more elaborate processes of construction, but still did not involve deductive reasoning.

Finally, item 19 asked for a deduction, which would allow the identification of level 4.
Items 8, 10 and 19 had a key role in the analysis.
8. Are there triangles that are isosceles and acutangle at the same time? Justify your answer with an example.
10. What properties of the inner and outer angles of a triangle do you know?
19. In this figure (figure 1), can we say that AB = DE. Why?

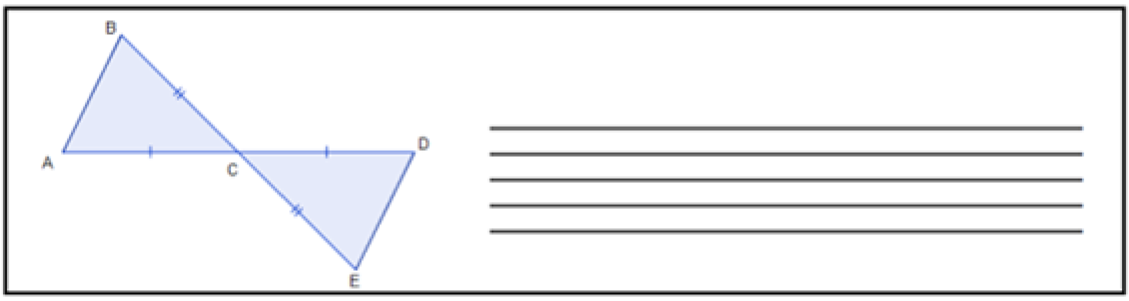

Figure 1. Proposed problem

Follows the classification rule employed, which was able to precisely classify all students.

Level I: Student correctly answered at least one question of group 1 and no question of higher level.
Transition from level I to level II Student correctly answered at least one question of group 1 and one question of group 2 and no other question.

Level II: Student answered correctly two or more questions of group 2. Answering correctly at least one question of group 3 also indicates that the student has attained at least this level.
Transition from level II to level III: Student answered correctly two or more questions of group 2 and at least one question of group 3 different from questions 8 and 10.

Level III: Student answered correctly Question 8, Question 10 or more than one question of group 3.
Transition from level III to level IV: Student answered correctly Question 8, Question 10 or more than one question of group 3 and answered correctly Question 19 but was not able to present a correct justification.

Level IV: Student answered Question 19 at Level IV, presenting a well-grounded argument.

The distributions found in the pre-test, in the experimental and control classes, along the levels were, as follows. At level 1: 1 and 7 students; at level 2: 18 and 15 students, and, at transition levels, from level 1 to 2: 18 and 13 students; from level 2 to 3: 1 student in both. Above level 3 no student was found. These are levels where greater organization and abstraction of geometric thinking is required.

The Activities

The teaching of Geometry in the 8th year, by the school curriculum, addresses the study of quadrilaterals and triangles. The activities, supported by concrete didactic resources or not, were designed with the main function of solidifying and reinforcing concepts that should have been apprehended before. Another main objective was to combine Algebra and Geometry, to provide a teaching that allows the student to identify and associate forms with algebraic calculations.

Specific materials were built, developed according to the characteristics of the class and locality, but with possibilities of being adapted to other contexts.

The class was separated into groups and the division respected some criteria, among which the variation of classification levels. The presence of different levels in the same group had the aim of stimulating mutual aid, allowing for greater individual development of the members at lower levels. To assure individual involvement, individual portfolios were used, where all the productions made during classes were gathered.

Involving real world situations, activities in the Mathematics Education Laboratory must encourage students to explore, experiment, reason in an organized way and rescue assimilated concepts in order to expand their knowledge. The 15 activities consider, in addition to the interests of the students, their individual needs and levels of cognitive development according to van Hiele theory. As registered by de Villiers (2010), van Hiele attributed the main reason for the failure of the traditional Geometry curriculum to the fact that it was presented at a higher level than the students' level.At this point, we describe three of the activities performed in the experimental class.

Activity 1: Location in the Cartesian Plane and Geographical Coordinates

Goals. The student advances toward:

1. Recognize and represent in the Cartesian coordinate system;
2. Explore maps and associate the geographical coordinates of latitude and longitude with the Cartesian plane;
3. Perceive the richness of the regional variations found in the class.

Skills / Abilities

Use the geometric knowledge to perform the reading and representation of reality and act on it. Interpret the location and movement of people or objects in three-dimensional space and their representation in two-dimensional space. Solve problem-situations involving geometric knowledge of space and form.

Procedures

1. The activity begins with a research task, where students raise characteristics of their places of origin, including latitudes and longitudes. At another time, and with a political map, students are encouraged to locate them through the coordinates surveyed.
2. The teacher can use datashow to exemplify the location of a state through latitude and longitude coordinates.
3. It is interesting for students to record all locations that arise in the class so that, at the end, they can compare distances, common characteristics, and regional differences. This activity can be performed in conjunction with the discipline of Geography.
4. The students receive a card with a Cartesian plane with some points marked. The students should represent them with the aid of elastics on the board of a Geoplane and register their ordered pairs. They should then locate some points according to ordered pairs provided.

5. The student should receive information about the Cartesian coordinate system, its nomenclature and representations to complete the task.
6. The verification of the results of the activity can be done by comparison of the Geoplane boards of the groups. The teacher should be alert to correct every shortcoming that may arise.
Educational resources: Political map and Geoplane board.

Application of the Activity

We can associate the Cartesian Plane with latitude and longitude, themes of Geography. The Global Positioning System allows finding the exact location on Earth. The Cartesian plane was explored through this path, because the students had quite different origins. The activity provided an appreciation of the cultural differences present in the classroom.

In some cases, students used two perpendicular rulers to locate their home state. There were no obstacles to the accomplishment of this activity, they showed interest in carrying out the task and were surprised by the different localities that appeared.

In the sequence, the Geoplane board with its two perpendicular axes, one horizontal and one vertical, which intersect at the origin of the coordinates. It was established how the Cartesian coordinates are ordered pairs (x; y).The names of the horizontal axis of abscissa (x) and the vertical of ordinate (y) were taught. Emphasis was given to the correspondence of the points in the axes to the numbers in the set of real numbers.

Some students confused abscissas with the ordinates, but the board of the Geoplane contained this information. This fact facilitated the location later.

The activity was adapted so that the students developed familiarity with the representations in the Cartesian plane. This activity will enable students to further assimilate the algebraic and geometric representations of a system of first-degree equations with greater ease.

Activity 2: Condition of Existence of a Triangle

Goals. The student advances toward:

1. Understand triangles with the aid of concrete materials.
2. Investigate a condition for the existence of a triangle.

Skills / Abilities

Relate information, represented in concrete and abstract forms to build consistent argumentation. Use geometric knowledge to perform the reading and representation of reality and act upon it. Identify characteristics of polygons. Use geometric notions in the selection of arguments and proposal of solution of daily problems.

Procedures

1. The student receives sets of three strips of cardboard and is informed about their length. Receives also brackets to join the strips.
2. The student should try to join the ends with the brackets. Sometimes, it will be possible to form a triangle; sometimes it will not be possible. They will then be asked to justify this impossibility.
3. The student should report in an activity sheet the conclusions reached.
Didactic resource: Strips of paper. Brackets.

Application of the Activity

This problem, if presented in the traditional way, does not raise much interest. The students do not believe that it is not possible to construct a triangle with sides of any length. The activity lays in concrete terms an abstract aspect of Mathematics.

Intentionally two situations are simulated for the construction of polygons with received strips. Because there are three "angles" the polygon is a triangle.

It was very interesting to note the students' surprise when they could not join the sides to build the polygon. The students began to inquire and comment that something was wrong.

Student: "Teacher, is this a bit of a catch-up with us? This will never close! "
Teacher: "Are you sure it does not fit? What is the cause of it? Did not the other combine? What happened to make things change? ".
After they realized the impossibility, they received the confirmation and handed a sheet of paper to record their answer to the questions "What happened in each case?" and “why it happened”, to fill spaces comparing with the signs of “<” and “>” the sums of two of the lengths and a third length. The students completed the information comparing them with signs of greater, lesser or equal. Finally, they were asked to write a justified answer the abstract question: "Given any three measures, is it possible to construct a triangle whose sides have these measures?”

Activity 3: Comparing measurements without measuring

Goals: The student advances toward:

1. Compare the measurement of the area of figures without directly measuring each of them.
2. Explore the conservation or modification of measures of the area of polygonal figures using checkered meshes.

Skills / Abilities:

Build and develop notions of size and measure to understand the reality and to solve everyday problems. Solve problem-situations involving different quantities. Select suitable units of measure. Evaluate the reasonableness of numerical result in the construction quantitative statements. Evaluate proposals of intervention on the reality, using geometric knowledge.

Procedures:

1. Students should construct an isosceles trapezoid on the Geoplane and record the measures of the bases and the height.
2. Next, draw the diagonals with the aid of a rubber band.
3. Then, in a checkered grid register the polygon built on the geoplaneGeoplane and name the vertices.
4. Finally, compare the area of triangles formed with three of the four vertices.
5. The teacher instigates the students, during the exploration, trying to correct possible hasty generalizations. Didactic resource: Geoplane.

Application of the Activity

It is customary in mathematics to compare numeric measures to determine whether some figure is larger, equal or smaller than another? But when it comes to comparing measures without measuring, there is a curiosity about what can be done. Under this perspective, this activity allowed the student to compare the areas of polygons without directly measuring them properly. The student should solve problems that appear in practice when comparing the areas of delimited regions. For the 8th-graders, it is very strange to come across a mathematical problem with no apparent numerical quantities.

Firstly, to prepare the students, a construction task is performed in the Geoplane that makes possible to compare the measures. The activity starts with the construction of a trapezoid in the Geoplane, where it is easy to identify the larger and the smaller basis. Next, the students are instructed to draw the diagonals with the aid of a rubber band. After that, they are asked to use their knowledge, about bases, heights and areas of triangles, to compare the areas of the triangles formed.

The students are led to discover that the triangles with the same basis have the same area and triangles with the larger basis have larger areas, because their heights are equal. The students solve the problem without having to measure or calculate. They may be surprised with some equalities but understand their proof.

The activity was concluded proposing a real problem situation that involved an important issue in the scenario of deforestation and environmental imbalance. In a map, a region in the form of an escalene trapezoid was selected and the students were asked to highlight sub-regions of equal area.

Results and Discussion

After these actions were implemented in the Mathematics classes, a post-test was applied to evaluate the progress of each student. The same test initially applied again to the two classes. Not all the 38 students in the experimental class and the 36 students in the control class present in the pre-test were not present for the post-test application. Only 32 students of the experimental class and 27 students of the control class appeared.

In both classes, the students presented improvements, but it could be verified which method produced greater progress in the students' performances. The results of the two classes in the pre-test and in the post-test are summarized in (Table 1).

Table 1. Pre-test and post-test levels

	Experimental class		Control class	
Level	Pre-test	Post-test	Pre-test	Post-test
I	1	0	7	0
I – II	18	0	13	6
II	18	9	15	15
II – III	1	13	1	3
III	0	6	0	3
III – IV	0	4	0	0

In the pre-test, the two classes initially presented small difference in relation to the global presence of the highest van Hiele levels. It can be observed only a greater homogeneity in the experimental class, with a larger number of students at the level II and in the transition from I to II.

The results obtained with the application of the post-test, after the interventions, in the experimental and control groups are more distanced. (Table 2) shows in the experimental class the highest number of students in transition from level II to level III, more students in level III and even four students in transition from III to IV, against none in the control class. On the other hand the control class presented a higher number of students in level II, which is now the lowest level as no student remained at the basic van Hiele level in either class.

The percentage of students above level II at the end of the school year gives also a clear indication. It can be extracted from (Table 1) that the experimental class had in this situation 23 students, or 71.8% of the total of 32 students examined, while the control class had only six, or 22.2% of its total of 27. Note that at the beginning there was only one student in each class in this situation.

The global improvement can be also compared in (Table 2), which shows that, while the control class had 51.9% of its students changing to a higher level, the experimental class had 87.5% of the students passing to a higher level.

Table 2. .Percentage of students with improvement

Class	Students improving	Total of students	%
Experimental	28	32	87.5
Control	14	27	51.9

(Tables 3) and (Tables 4) detail the changes by level, for the students present at the two tests, in the experimental and the control class. It reveals the advances obtained by each student of a different initial level.

Table 3. Performance of the experimental group in the pre-test and post-test

Pre-test	I	I - II	II	II - III	TOTAL
Post-test					
II	1	4	4	0	9
II - III	0	7	6	0	13
III	0	2	3	1	6
III - IV	0	0	4	0	4
TOTAL	1	13	17	1	32

Table 4. Performance of the control group in the pre-test and post-test

Pre-test	I	I - II	II	II - III	TOTAL
Post-test					
I-II	1	4	0	0	5
II	2	4	9	1	16
II - III	0	1	2	0	3
III	1	0	2	0	3
III - IV	0	0	0	0	0
TOTAL	4	9	13	1	27

In (Table 3), it can be seen that there were 14 students of the experimental class initially classified at level I and in the transition from level I to II and all of them advanced to level II. Only four of 17 students initially in level II remained at that level. The only student who was initially in the transition from level II to III advanced to level III. Finally, all four students who were classified at the transition from III to IV in the post-test were initially at level II. Thus, although progress along the year might be expected to occur only to the next level, larger jumps occurred.

The same investigation was carried out in the control group. It can be seen in Table that among the students that took the post-test, four were initially at level I and all advanced. Of those who were in the transition from level I to II, four advanced to level II and one advanced for transition from II to III. On the other hand, four, from the total of nine, remained in the original position. There were 13 at level II and nine of them remained at that level. The other four advanced to higher levels.

It can be noticed that one student who had been classified in transition from level II to III was now classified in level II. This result highlights the difficulty in the development of geometric reasoning of the student who faced a traditional teaching.

Conclusion

A methodology of development of activities involving everyday situations and interdisciplinary approaches, with active students' participation in a Laboratory of Mathematics and with application of tests to evaluate van Hiele levels was here presented. It involved a series of activities specially designed to facilitate the development of Geometric reasoning.

The proposal applied to an experimental group provided an environment conducive to meaningful learning. It must be pointed that it also increased students' confidence and stimulated them to develop continuity for the acquisition of new knowledge.

Recommendations

This experiment highlights the importance of the development of specific didactic materials, designed with a view to the construction of knowledge and to the encouragement of creativity, for the development of students' geometric thought.

Acknowledgements

We thank all those who collaborated for this research: students, parents, school, City Hall of Macaé, Colégio Pedro II, Plataforma Brasil and for the opportunity granted to share our course and research results for the international academic community.

References

Ausubel, D. P. (1961). *Meaningful Learning and Retention: Intrapersonal Cognitive Variables*. Review of Educational Research, 31, 500-510.

Crowley (1984). *The van Hiele Model of the Development of Geometry Thought In Lindquist*, M.M. & Shulte, A.P., Learning and Teaching Geometry. National Council of Teachers of Mathematics, Resbon-VA.

De Villiers, M. (2015, Jan 10). *Research evidence on hierarchical thinking, teaching strategies and the Van Hiele Theory: Some critical comments*. University of Stellenbosch: Rumeus, General format. Retrieved from http://math.kennesaw.edu/~mdevilli/VanHieleCritique-87.pdf.

Fouz, F. & de Donosti, B. (2015, May 8). *Modelo de Van Hiele para la didáctica de la geometría: Un paseo por la geometría*. General format. Retrieved from <http://cimm.ucr.ac.cr/ciaem/articulos/universitario/materiales>

Jaime, A. (1993) *Aportaciones a la interpretación y aplicación del Modelo de Van Hiele: La enseñanza de las isometrías en el plano. La evaluación del nivel de razonamiento.* D. Sc. Thesis, Universidad de Valencia, Spain.

Nasser, L.*Using the van Hiele theory to improve secondary school geometry in Brazil*. (1992). D. Sc. Thesis – London King's College, University of London, London.

Skovsmose, O. (1994). *Towards a critical mathematics education. Educational Studies in Mathematics*. (25), p. 35-57.

Tomaz, V. S.; David, M. M. *How students' everyday situations modify classroom mathematical activity: the case of water consumption*. Journal for Research in Mathematics Education, 46 (4), 455–496.

Van Hiele, P. (1986) Structure and Insight: *A Theory of Mathematical Education. Academic Press*. London.

Vargas, G. V. & Araya, R. G. (2013). *El modelo de Van Hiele y la enseñanza de la geometría*. *Uniciencia*, 27(1), p. 74-94.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 261 - 268

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

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Abstract: This research seeks to compare the inculcation of the value of rationalism through the form four mathematics textbooks from Victoria (Australia) and Malaysia. One textbook is analyzed from each of the countries. Two chapters were chosen from both of the textbooks, namely Linear Equations and Trigonometry. Contents analysis was used to analyse evidence of the value of rationalism. Five characteristics of the value of rationalism are identified namely reason, explanation, abstraction, logical thinking and theorem. We found inculcation of the value of rationalism was moderate. However, the value of rationalism with characteristics of hypothetical reasoning was missing from both of the textbooks. Both textbooks inculcate the value of rationalism with characteristics of reasons fairly moderately. The inculcation of the value of rationalism with the characteristic of explanation appeared significantly in both textbooks. In contrast, the inculcation of the value of rationalism with characteristics of abstraction and theorem appeared only in the Mathematics Form 4 of the Malaysian textbook. This study highlights the need to inculcate the value of rationalism more thoroughly, especially the value of rationalism with characteristics of reason, hypothetical reasoning and logical thinking. The inclusion of the value of rationalism in the mathematics textbooks will enable students to understand mathematical concepts more deeply and meaningfully.

Keywords: Mathematical values, Value of rationalism, Reason, Explanation, Abstraction, Logical thinking, Theorem and hypothetical reasoning

Introduction

Textbook is considered as a main source of knowledge, skills and values to students. However, are the textbooks having enough qualities to advance students" knowledge, skills and values? The textbook is commonly to be used in any teaching and learning processes in the classroom (Hiebert, Gallimore, Gamier, Giwin, Hollingsworth & Jacobs, 2003). However, Bishop (1988) argue that mathematics teaching is distant from real life situation, and does not how mathematics idea come into mind.

Value is one of the important domain, beside cognitive and effective. Cao, Seah and Bishop (2006) states that "Values are standard for making judgments on what in important…, and they occupy a more central place in our belief system compared with other affective qualities such as attitudes and beliefs…" (page 483). According to Bishop (1988), values can be categorized into three, i.e., general educational values, mathematical values and mathematics educational values. General education values are values related to moral and ethical, however mathematics educational values are values related to pedagogical approaches. However for the purpose of this article, one of the mathematical values, especially the value of rationalism will be the only focus of discussion.
There were a few research indicated that, the mathematical values can be identified in the mathematics textbooks from Singapore, China dan Australia (Cao, Seah, & Bishop, 2006; Seah, & Bishop, 2000). According to Stacey and Vincent (2009) secondary mathematics textbooks in Australia follows a general pattern of introducing new content with explanatory text with one or more worked examples, before presenting a set of exercises for students to solve. Are mathematics textbooks interesting enough for students to learn mathematics?

Are mathematics textbooks having qualities to instill the mathematical values, especially value of rationalism to students?

Value of Rationalism

Mathematical values are qualities related to the characteristic of the mathematics itself and concern how the discipline of mathematics is developed by mathematician from different cultures (Bishop, 1988). Mathematical values are related to the aspect of epistemological mathematics as a discipline (Bishop, 1988; Cao, Seah, & Bishop, 2006; Seah, & Bishop, 2000). The value of rationalism is one of the values in the mathematical values category.

Value of rationalism concerns the use of logic skills available and thus it emphasises the range of values associated with those skills, such as reason, explanations, hypothetical reasoning, abstraction, logical thinking and theories (Bishop 2008; Bishop, Clarke, Corrigan & Gunstone, 2006). The value of rationalism is the most dominant value underpinning teaching and learning mathematics, because it involves logical ideas, hypothetical and reasoning (Bishop, Clarkson, FizSimons & Seah, 2000; Seah & Bishop, 2000).

The mathematical values, namely the values of rationalism could be inculcated to the students during the learning processes in the classroom. The inculcation of the values of rationalism might be happened either explicitly or implicitly. Through the learning processes, the content of the textbooks will be explored by the students and at the same times, either explicitly or implicitly, the value of rationalism could be inculcated into the value‟s system of the students. Therefore what kind of values and how the values are embedded throughout the mathematics textbooks are very important as sources of experience to students.

There were a few studies about comparing the inculcation of the mathematical values through mathematics textbooks from various countries (Seah & Bishop, 2000; Cao, Seah and Bishop (2006). Comparing the mathematics textbook from China and Australia, Cao, Seah and Bishop (2006) concluded that, the China textbook demonstrate more emphasis on inculcation the value of rationalism, than the Australian textbook under studied. Generally the textbooks from both countries (China and Australia mathematics textbooks under studied) feature the value of rationalism logical connectors and introduction of theorem and formula through proof more prominently.

Another research was conducted by Seah and Bishop (2000) to compare the inculcation of the mathematical values in mathematics textbooks from Australia and Singapore. They concluded that, inculcation of the values of rationalism in Singapore mathematics textbooks was strongly communicated through the use of logic connectors such as 'thus', 'so', 'therefore„ and 'hence', all of which imply cause-and-effect and deductive reasoning. Generally, the values of rationalism had been found and emphasized in Australian and Singaporean textbooks (Seah & Bishop, 2000).

Objective of the Research

Generally, the focus of this research is to identify and compare the mathematical values (specifically the value of rationalism) inculcated through the mathematics textbooks of Malaysian and Australian curriculum. Two objectives were to:

- identify the value of rationalism in the Malaysian and Australian mathematics textbooks.
- compare the strengths and weaknesses of the value of rationalism in the Malaysian and Australian mathematics textbooks.

Methodology

The analysis involves one Year 10 secondary school‟s mathematics textbook from Malaysia and Victoria, Australia. The mathematics textbook from Victoria, Australia is TVA Mathematics Textbook (pseudonym), while from Malaysia is TMA Mathematics Textbook (pseudonym). Two chapters were chosen from each of the textbook, namely “Linear equation” and “Trigonometry”. Contents analysis approach is used to analyse the data. Focus of the analysis were the value of rationalism in both textbooks. Analysis were based on the characteristics of the mathematical values, namely value of rationalism as described by Bishop (2008), Bishop, Clarke, Corrigan & Gunstone, 2006, Seah & Bishop (2000), Cao, Seah, & Bishop (2006) and Dollah (2007) and

Dollah, Saad and Abdullah (2014) (Table 1). Research validity and reliability were identified through experts" opinion and member checking validation.

Data Analysis

The discussion about value of rationalism is based on six characteristics, namely reason, explanation, hypothetical reasoning, abstraction, logical thinking and reasoning (Table 1).

Value of Rationalism - Reason

The inculcation of the value of rationalism with characteristics of reasons from the whole chapters of "Linear equation" and "Trigonometry" throughout both textbooks were fairly moderate. The inculcation of the value of rationalism with characteristics of reasons were identified from the used of the words such as "why" and "because" to obtain reasons. Generally, both textbooks rarely contain the words ask for "reason" from the readers or students (see Table 2).

One example of the used of "why" in a mathematics problem from TVA textbook is: **"***Which formula should they use? Why?"* (TVA/LE /pg58/2.01/VR002). Another example involving the uses of "because" as the following: "*Solving a linear equation, such as 2x + 1 = 7, means finding the value of x that makes the mathematical statement true. In this case there is only one answer, x = 3. We know this is true because 2 × 3 + 1 = 7*". (TVA/LE/ pg78/2.07/VR007).

Throughout the TMA Mathematics textbook, there were a few texts involve the word "why". One example is in the following excerpt: "*Using two sinusoid graph drawn on the same axis as illustrated, explain why populations of foxes and rabbits changed cyclically*" (TMA/Trigo/ pg252/9.2c/VR006).

Table 1. Value of rationalism - characteristics

Characteristic	Description
Reason	Giving reasons should enable the people affected by the decision to understand why a particular decision was made (Ombudsman Western Australia, 2016); Reason for the action/ cause and effect (Seah & Bishop, 2000).
Explanations	Explanation refers to an act of explaining the process and product of an act (Rubin, 1992); Explanation is made for students understand mathematical concepts (Dollah, Saad & Abdullah (2014) Explanation on mathematical concepts.
Hypothetical reasoning	A proof involves reasoning from something that is known/ a hypothesis;These are rules of the form A ← (B ← C), which means, "A is true if adding C to the rule base causes B to be true." (Bonner, 1988); Hypothetical reasoning or reasoning under assumptions is a key concept of logic (Schroeder-Heister, 2014).
Abstraction	We claim that the essence of abstraction in mathematics is that mathematics is self-contained: An abstract mathematical object takes its meaning only from the system within which it is defined (Mitchelmore & White, 2004); Abstraction is a process of generalisation, removing restrictions, eliminating detail, removing inessential information (Ward, 2003); Abstraction involved (Cao et al., 2006)' Conceptual process by which general concepts or rules are derived from the usage or specific examples.
Logical thinking	Logical thinking is a process that involves moving from one related statement (antecedents) or thought to another (consequents) (Study.com, 2015). Interconnecting mathematical ideas – inductive and deductive reasoning (Durant-Law, 2013). Reasoning is a process of thought that yields a conclusion from precepts, thoughts, or assertions (Johnson-Laird, 1999).
Theorem	Theorem—a mathematical statement that is proved using rigorous mathematical reasoning. In a mathematical paper, the term theorem is often reserved for the most important results (Richeson n. d.); Introduction of theorem and formula through guided induction (Cao et al., 2006).

Value of Rationalism - Explanation

Inculcation of the value of rationalism with characteristic of explanation is identified very significantly throughout both textbooks. The inculcation of the value of rationalism-explanation can be identified from the layout/presentation by both chapters from both textbooks. Generally the layout/presentation both of the textbooks are almost similar. Each of the chapter from both of the textbooks begin by giving a list of learning objectives, followed by explaining about some mathematical concepts (including examples and exercises), rich task and end with mathematical questions under the topic “Review”.

Learning Objective of the Chapter

Both textbooks begin each of the chapter by highlighting the learning objective. One example of learning objective is taken from the chapter “Linear equations” of TVA mathematics textbook as the following:

- *identify different types of mathematical graphs and their names solve linear equations.*
- *sketch linear equations.*
- *find the equation of a straight line from data and a graph.*
- *solve simultaneous equations using the method of substitution and the method of elimination.*
- *sketch and solve linear inequalities.*
- *make mathematical models of real-world situations.*

(TVA/LE /pg53/Intro/019).

One example of learning objective is taken from the chapter “Linear equations” of TMA textbook as the following excerpt:

- *Learning objectives.*
- *Understand the concept of the slope of the line.*
- *Understand the concept of the slope of the straight line in the Cartesian coordinate system.*
- *Understand the concept of intercept.*
- *Understanding and using the straight-line equation.*

(TMA/LE/pg113/Intro/VR020)

Learning Objective of Each Topic

However, only TMA mathematics textbook have learning objectives for each topic in every chapters. Below is one of the example of the learning objective of the topics in Malaysia mathematics textbook:

- *Learning outcome*
- *To determine “rise” and “run” between two given coordinates on a straight line.*

(TMA/LE/pg114/5.1/VR021)

Table 4.1.1 Inculcate the value of reason

TVA Maths			**TMA Mathematics Malaysia**				
Topic	Use of “why”	Use of “Because”	Topic	Use of “why (mengapa)”	Use of “because (kerana)”	Use of “because (sebab)”	reason (alasan)
2.01							
2.07		Note (TVA/LE/ pg78/2.07/…).	5.2b				Math Problem (TMA/LE/pg122/5.2b/…).
9.01		Note (TVA/Trigo/ pg290/9.01/…).	5.4a		Note (TMA/LE/ pg127/5.4a/VR4)		
		Note (TVA/Trigo/ pg290/9.01/…).					
9.05			5.4e		Note (TMA/LE/ pg131/5.4e/VR5)		
9.06		Note (TVA/Trigo/ pg310/9.06/…).	9.1f			Activity (TMA/LE/ pg241/5.4e/…)	
9.07		Note (TVA/Trigo/ pg317/9.07/…).	9.1g			Example (TMA/LE/ pg243/9.1g/…)	
			9.2c	Note (TMA/Trigo/ pg252/9.2c/…)			

Introduction of the Chapter

There are two ways to introduce the topic, namely through history of mathematical concept and application of mathematical concepts in real life situation. The TVA mathematics textbook use both ways to introduce the chapters. One example of the used of history when TVA mathematics textbook inserting photographs of Rene Descartes to introduce the chapter “Linear equation”. Another example involve the application of mathematical concepts of “Using simultaneous equation to maximise profit in business” that can be found in the TVA mathematics textbook.

The TMA mathematics textbook mostly used application of math concepts in real life situation as introduction of the chapters. One example, the concept of topology is used as introduction of the chapter of “Linear equation”. Another example, the used of “estimating the position, distance and altitude of a place on earth” as introduction of the chapter “Trigonometry”.

Main Contents

The TVM mathematics textbook contains main contents or concepts through sub topic “Big Idea”. Generally, the sub-topic “big ideas” is presented after the sub-topic "Activity". One example of “Big ideas” from the chapter “Linear equations” by the TVM mathematics textbook gives explanation about what is function, examples of functions, terms and symbols of functions. (TVA/LE/pg54/.06/VR023). Another example of “Big ideas” is from the chapter of the Trigonometry that explaining about trigonometric ratios, namely sins, cosine and tangent using the mnemonic forms, such as SOH (Sine equal Opposite over hypotenuse), CAH (Cosine equal Adjacent over hypotenuse) and TOA (Tangent equal Opposite over Adjacent) (TVA/Trigo/pg298/9.03/VR024).

However, throughout the TMA mathematics textbook, the notes/big ideas are not presented under specific subtopic as in TVA textbook. Usually notes/big ideas are given at the beginning of each subtopics, before the students are exposed to activity or math questions. One example of notes/Big ideas of mathematical concepts discussed in the TMA mathematics textbook is about determining an angle in any quadrant of a unit circle using “trigonometry” (TMA/Trigo/pg231/9.1a/VR025).

Worked Examples

The value of rationalism with characteristics of explanation by both textbooks are shown through the use of worked examples. Generally, in every topic under the chapters "Linear equations" and “Trigonometry” throughout both of the textbooks, these are highlighted in a specific sub-topic called "worked examples” before some mathematical problems or exercises.

In the TVA mathematics textbook, the worked examples are shown in more detail compared to in the TMA mathematics textbook. The worked examples in the TVA mathematics textbook, Not only explain about “plan of procedure” and “solution execution” to the mathematical problem but also attached with links to some source of references (TVA/LE/pg61/2.02/VR027).

The Worked examples in the TMA Mathematics textbook is shown by giving the solution and short note about history of the related concepts. One example of worked example is about mathematical problem involving unit circle. The worked example explained about the solution and also with an insert. The insert contains a short note about history of trigonometry is attached to the mathematics examples (TMA/Trigo/pg323/9.1a/VR029)

Value of Rationalism - Hypothetical Reasoning

The inculcation of the value of rationalism with characteristic of hypothetical reasoning cannot be identified in both of the textbooks under reviewed.

Value of Rationalism - Abstraction

The value of rationalism with the characteristic of abstraction only can be identified from the TMA mathematics textbook, but cannot be found from TVA Mathematics Textbook. Based on TVA mathematics textbook, both chapters under studied did not end with generalization, but only with mathematics problem as exercises. Nonetheless the value of abstraction is identified in the TMA mathematics textbook through concept mapping in form of diagrams. The concept mapping is presented at the end of each of the chapters (Linear equations and Trigonometry) which were labelled as "summary".

For example, the concept mapping in the topic of Trigonometry is given in diagrammatic form that comprise of the main topic in the chapter of "Trigonometry II".

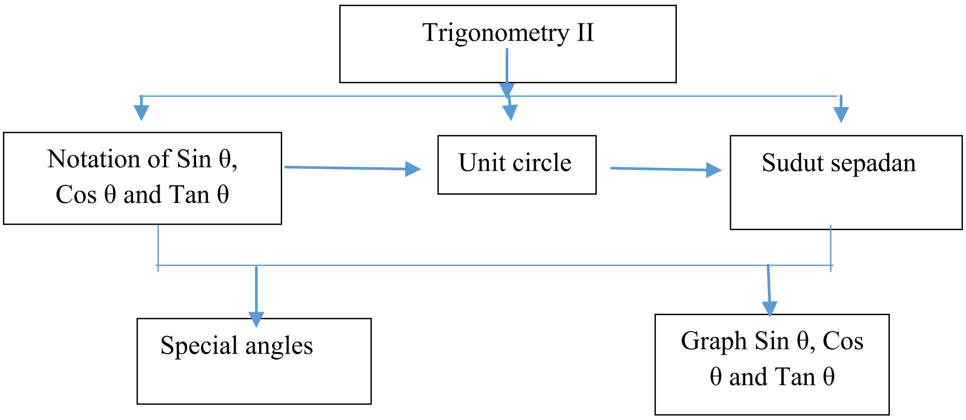

Diagram 1. The concept mapping in the topic of Trigonometry (TMA/Trigo/pg253/ConceptMap/VR030)

Value of Rationalism - Logical Thinking

The inculcation of the value of logical thinking is identified from both of the chapters "Linear equations" and "Trigonometry" of both of the textbook. The Inculcation of the value of logical thinking is identified in two ways, namely deductive and inductive reasoning. Generally, the value of logical thinking is identified through work examples and activities. The TVA mathematics textbook is more emphasized on deductive reasoning then inductive reasoning. However the TMA textbook fairly emphasized on both, namely deductive and inductive reasoning.

Inductive Reasoning

The Inductive reasoning is identified when the mathematics task aimed to formulate a generalization based on specific pattern of observation. The TMA mathematics textbook more emphasized on inductive reasoning than TVA mathematics textbook. The inculcation of the value of logical thinking is identified through work examples and activities from both of the textbooks.

One example of inductive reasoning from the chapter "Linear equation" of TMA mathematics textbook is when the activity aimed to formulate a formula of gradient of straight line based on pattern of gradient obtained from a few pairs of point on straight line given (TMA/LE/pg118/5.2a/VR031).

The Inductive reasoning is rarely identified through TVA textbook. All the inductive reasoning from TVA Mathematics textbook can be identified through activities. One example of inductive reasoning from TVA Mathematics textbook is the activity involves a toy car moving down an adjustable slope. The activity is to conclude pattern of relationship between gradient and speed of an object moving down the slope (TVA/LE/pg64/2.03/VR033).

Deductive Reasoning

The deductive reasoning is identified when reasoning goes from general (multiple premises that are considered to be true) to specific (conclusion). Deductive reasoning is identified very significantly from both of the textbooks.

Here is an example of the deductive reasoning from TVA mathematics textbook from the chapter "Linear Equation". The example come from worked example about determining the x-intercept and y-intercept for the given equation (3x – 5y = -15). The deductive reasoning is when the x-intercept and y-intercept are determined from premis namely “the line cutting the x-axis (when y = 0) and the y-axis (when x = 0)”. (TVA/LE/pg61/2.02/VR034)

Another example of logical thinking through deductive reasoning from the chapter of “Linear equation” of TMA mathematics textbook through application of general mathematics concepts, namely gradient, y-intercept and x-intercept, to find coordinates when a straight line passing through y-axis (TMA/LE/pg125/5.3b/VR037). The premises such as gradient, y-intercept and x-intercept are considered as true to find specific conclusion, this is coordinate when a straight line passing through y-axis.

Value of Rationalism - Theorem

The inculcation of the value of rationalism with characteristic of theorem is only identified in the TMA mathematics textbook, but cannot be identified in the TVA mathematics textbook. The inculcation of the value of theorem in the TMA mathematics textbook happened only in a few cases through activities. All of the activities involved to prove mathematical formulas using inductive approaches.

One example of the inculcation of the value of rationalism with characteristic of theorem is through an activity to prove formula of gradients “gradient = $\frac{y2-y1}{x2-x1}$ “ is similar to the “ $-\frac{y-intercept}{x-intercept}$. “

(TMA/LE/pg124/5.3b/VR039).

Discussion and Conclusion

Generally, the inculcation of the value of rationalism can be identified from both of the chapters, namely “Linear equation” and “Trigonometry”, of the textbooks under studies. However, the inculcation of the value of rationalism is moderate to all of its characteristics, namely reason, explanation, hypothetical reasoning, abstraction, logical thinking and theorem.

Three characteristics of the value of rationalism were identified from both textbooks under studied, namely reason, explanation and logical thinking. The inculcation of the value of rationalism with characteristics of reasons from both textbooks are fairly moderate. The used of words or phrases that ask the students to give reasons from both textbooks are rarely appeared. The inculcation of the value of rationalism with the characteristic of explanation appeared very significantly in both of the textbooks.

Logical thinking is another characteristic of the value of rationalism that gave emphasize moderately by both of the textbooks. The characteristic of logical thinking can be found through activities and worked example in both of the textbook. However, based on the research comparing the inculcation of mathematical values in mathematics textbook from Australia and Singapore that was done by Seah and Bishop (2000), the value of rationalism in Singapore mathematics textbooks was strongly communicated through logical thinking, namely deductive reasoning.

The Malaysia mathematics textbook is more diverse in inculcating the value of rationalism. This is supported by the finding that, the characteristic of value of rationalism namely abstraction and theorem only can be found in the Malaysia mathematics textbook. However, based on the research comparing the inculcation of mathematical values in mathematics textbook from Australia and China that was done by Cao, Seah and Bishop (2006), the value of abstraction only can be found in China Mathematics Textbook. However, from this research that involves the TVA Mathematics textbook and the TMA Mathematics textbook, the value of rationalism with characteristics of hypothetical reasoning is missing from both of them.

This study highlights the need to consider the inculcation of the mathematical values, especially the value of rationalism more thoroughly and significantly in the mathematics textbooks. There are many characteristics of the value of rationalism that can be found in the mathematics textbooks from both of the country, such as reason, explanation, and logical thinking. However the textbooks should put more emphasized on inculcating the values of rationalism, especially the characteristics of reason, hypothetical reasoning, logical thinking and theorem, so that students will understand mathematical concepts more deeply and meaningfully.

Reference

Bishop, A. J. (1988). Mathematics education in its cultural context. *Educational Studies in Mathematics, 19,* 179-191.

Bishop, A. J., Clarke, B., Corrigan, D. & Gunstone, D. (2006). Values in mathematics and science education: researchers‟and teachers‟ views on the similarities and differences. *For the Learning of Mathematics*, 26, 1, 7 – 11.

Bishop, A. J. (2008). Values in Mathematics and Science Education: similarities and differences. *The Montana Mathematics Enthusiast*, ISSN 1551-3440, Vol. 5, no.1, pp. 47-58.

Bishop, A. J., Clarkson, P., FitzSimons, G., & Seah, W. T. (2000). Why study values in mathematics teaching: Contextualising the VAMP project? *Australia: Values And Mathematics Project (VAMP).* Retrieved November 16, 2001, from http://www.education.monash.edu.au/projects/vamp/mav98.html.

Bonner, A. J. (1988). *A Logic for Hypothetical Reasoning*. AAAI-88 Proceedings. Copyright ©1988, AAAI (www.aaai.org), 480 – 484.

Cao, Z., Seah, W. T. & Bishop, A. J. (2006). A comparison of mathematical values conveyed in mathematics textbooks in China and Australia. In F. K. S. Leung, K-D. Graf, & F. J. Lopez-Real (Eds.), *Mathematics education in different cultural traditions – A comparative study of East Asia and the West*, 484 – 493. New York, N.Y.: Springer.

Durant-Law, G. (2013). *Logical thinking*. Seminar paper University of Canberra, Australia.

Hiebert, J., Gallimore, R., Gamier, H., Giwin, K. B., Hollingsworth, H., Jacobs, J., et al. (2003). *Teaching mathematics in seven countries: results from the TIMSS 1999 Video Study.* Washington, DC: National Centre for Education Statistics.

Johnson-Laird, P. N. (1999). Deductive reasoning. *Annual Review of Psychol.,* 109-135. Retrieve 15 Mei 2018 from http://matt.colorado.edu/teaching/highcog/fall8/j99.pdf.

Mitchelmore, M. & White, P., (2004). Abstraction in mathematics and mathematics learning. *Proceedings of the 28th Conference of the International Group for the Psychology of Mathematics Education*, Vol 3 pp 329–336.

Dollah, M. U. (2007). *Penerapan nilai dalam pengajaran guru matematik sekolah menengah: Satu kajian kes.* Unpublished PhD thesis, Universiti Sains Malaysia.

Dollah, M. U., Saad, N. S. & Abdullah, M. F. N. L. (2014). *Nilai matematik dalam pengajaran matematik pjj sekolah rendah.* A monograph of research grant 2012-0136-107-01, Sultan Idris Education University, Malaysia.

Ruben, D. H. (1992). *Explaining explanation.* NY: Routledge.

Schroeder-Heister, P., (2014). *CfP Hypothetical Reasoning.* Conference on Hypothetical Reasoning, 23-24 August 2014 in Tübingen, Germany. Retrieve on 8 Nov, 2015 from http://www.cs.nyu.edu/pipermail/fom/2014-April/017953.html

Richeson, D. (n. d.). *What is the difference between a theorem, a lemma, and a corollary?* Retrieved on 18 January 2016 from file:///D:/WHAT%20IS%20THE%20DIFFERENCE%20BETWEEN%20A%20THEOREM,%20A%20LEMMA%20AND%20OTHER%20TERMS.pdf

Seah, W. T., & Bishop, A. J. (2000). *Values in mathematics textbooks: A view through two Australasian regions.* Paper presented at the 81st Annual Meeting of the American Educational Research Association, New Orleans, LA, April 24-28.

Stacey, K. & Vincent, J. (2009). *Modes of reasoning in explanations in Australian eighth-grade mathematics textbooks.* Educational Studies in Mathematics, 72, 271-288.

Study.com, (2015). *Logical Thinking: Definition & Process.* Retrieve on 19 Disember 2015 from http://study.com/academy/lesson/logical-thinking-definition-process-quiz.html

Ward, M. (2003). *A Definition of Abstraction. Computer Science Dept Science Labs South Rd Durham DH1 3LE.* Retrieved on 18 Jan 2016 from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.65.3973&rep=rep1&type=pdf.

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ISRES Publishing

The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 269-275

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Measuring Bullying Among Students Using the Randomized Response Technique

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Abstract: Due to its sensitive nature, bullying is difficult to study empirically. The prevalence and the frequency of bullying are difficult to estimate using standard survey techniques due to the tendency of respondents to hide information in such settings. This behavior is known as social desirability, that is, the desire to make a favorable impression on others, and poses a significant threat to the validity of self-reports. Since the 1960s a variety of questioning methods have been devised to ensure respondents' anonymity and to reduce the incidence of evasive answers and the over/underreporting of socially undesirable acts. These methods are generally known as indirect questioning techniques (IQTs) and they obey the principle that no direct question is posed to survey participants. Therefore, their privacy is protected because the responses remain confidential to the respondents and, consequently, their true status remains uncertain and undisclosed to both the interviewer and the researcher. This paper describes a survey asking sensitive qualitative questions about bullying, conducted using one of the IQT, concretely, randomized response technique (RRT). This work tests the efficacy of RRT in establishing higher rates of truthful self-reporting when compared to traditional survey techniques.

Keywords: Bullying, Social desirability, Indirect questioning techniques, Randomized response techniques

Introduction

Since the decade of the 70s when the first empirical studies were carried out by Dan Olweus in Scandinavia, much attention has been addressed to this phenomenon first in Europe, soon afterwards in Japan, Australia and Northern America, but only recently in Latin America (Del Barrio et al., 2008).

Bullying has received scientific attention from different theoretical and methodological approaches in which some element of the phenomenon is focused (Kowalski, Giumetti, Schroeder y Lattanner, 2014). Despite this, there is some unanimity in its conceptual delimitation. Thus, it is assumed that bullying is a phenomenon of intentional aggression of one or some over another or others in a repeated and sustained manner, in which there is an imbalance of power between the aggressor and the victim (Olweus, 1993), definition in which three fundamental criteria stand out: (1) intentionality, (2) reiteration and (3) imbalance of power. In this regard, Ortega (1998, 2010) included the ethical dimension (4), in the sense of considering bullying as a behavior of moral transgression, insofar as both the aggressor and the direct observers of the phenomenon recognize it as an immoral and unjust behavior. On the other hand, it would be necessary to include besides physical and verbal bullying the two most easily recognizable prototypes, psychological and relational bullying (Furlong et al., 2005; Olweus, 1993). It is also necessary to analyze the bullying carried out through the Internet and, in general, the digital devices so widely used by adolescents and young people and that it is recognized as cyberbullying (Casas, Del Rey y Ortega-Ruiz, 2013; Slonje, Smith y Frisén, 2013; Tokunaga, 2010).

Very often the interest and concern are a result of the existence of severe incidents with a clear impact on the media, as for example suicides of adolescents, either declaring or not their inability to get away from the nightmare that his/her life at school had become. But research is also conducted as a consequence of the difficulties experienced by teachers in their daily school life. The need for improving the moral and emotional

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

atmosphere leads to the acknowledgement of the relevance of considering peer bullying and social exclusion as obstacles for an efficient and inclusive school. So, bullying is widely recognized as being a problem, not only for those individuals involved, but also for the organization within which it occurs and the wider community.

The second day of May is the World Day Against Bullying, a serious problem that affects millions of primary school and secondary school students worldwide and causes at least 200 deaths directly every year. This initiative was born in 2013 after the presentation of the Bullying Without Borders NGO, was approved by UNESCO in order to help raise awareness of this problem.

Since 2014, Observatory for Spain of the International Bullying Without Borders NGO together with the Multidisciplinary Team of Bullying Without Borders, formed by doctors, psychiatrists, psychologists, educational psychologists, educators, lawyers, journalists and parents of children and adolescents who have suffered bullying, carries out the National Bullying or Bullying Report in Spain. According to the report, the national statistics of bullying or school bullying notified 1004 victims in 2015, 1229 in 2016 and 1475 occurrences in 2017. The Communities of Murcia, Madrid, Catalonia and Andalusia are at the forefront with a number of serious cases of bullying, followed by the Balearic Islands and the Valencian Community. (ONG Bullying Sin Fronteras, 2018)

The age of the victims is decreasing, in 2016 the average age of the victim was reduced, currently it is 10.9 years, compared to the average age of 11.6 that was recorded between 2013 and 2015. In addition, cases of harassment at early ages have increased very significantly since assaults on children under seven years of age represent more than 14% of cases. On the other hand, the average age of the bullies is 11 years - it has also been reduced since last year in almost a year.

More than half of the aggressors in the face-to-face harassment are male, compared to cyberbullying where the profile is female, this gender difference between the attacks is due to the foundations to “the physical violence of males compared to the other ways they seek the girls to hurt”. In the case of cyberbullying, both foundations highlight the problem that causes bullying to occur outside the school environment and continuously, as the victims lose their privacy space, their home, where they feel protected.

The psychological problems derived from harassment are the same, even if it is face-to-face or virtual. Sadness, anxiety and fear continue to be consequences that persist in victims for longer than harassment lasts. In addition, in 8.4% of cases, almost one in ten, the victim has self-harmed and has even come to think or attempt suicide in his despair. (El Español, 2017).

In social research, we very often gather information relating to highly sensitive issues, as is the case of bullying. In these situations using the direct method of interview (asking questions directly to the respondents, DQ), the respondents provide often untrue response or even refuse to respond because of the social stigma and or fear. Such systematic response errors lead to social-desirability bias in prevalence estimates of the sensitive behaviors of interest, underestimating socially undesirable activities. To overcome these problems, indirect questioning techniques, such as the randomized response technique (Warner, 1965) may be used to collect more reliable data, protect respondents‟ confidentiality and avoid unacceptable rate of nonresponse. In the RRT, respondents use a randomization device (decks of cards, coloured numbered balls, dice, coins, spinners, random number generators, etc.) to generate a probabilistic relationship between their answers and the true values of the sensitive characteristic. The rationale of the RRT is that the respondents are less inhibited when the confidentiality of their responses is guaranteed. This goal is achieved because all responses are given according to the outcome of the randomization procedure, which is unknown to both the interviewer and the researcher and, hence, respondents' privacy is preserved.

The RRT has been applied in surveys covering a variety of sensitive topics like racism (Ostapczuk et al., 2009, Krumpal, 2012), drug use (Kerkvliet, 1994, Dietz et al., 2013, Goodstadt and Gruson, 1975, Striegel et al., 2006), abortion or delinquency (Fox and Tracy, 1986, Holbrook and Krosnick, 2010, Lara et al., 2006, Kuha and Jackson, 2014), AIDS (Arnab and Singh, 2010) or academic cheating (Fox and Meijer, 2008).

Standard RR methods are used primarily in surveys which require a binary response to a sensitive question, and seek to estimate the proportion of people presenting a given (sensitive) characteristic, for example, some authors who developed these models are Horvitz et al. (1967), Greenberg et al. (1969), Boruch (1972), Devore (1977), Kuk (1990), Mangat and Singh (1990),… Techniques also exist for quantitative variables, but these are not used as commonly, for example, Eriksson (1973), Eichhorn and Hayre (1983), Bar-Lev, Bobovitch and Boukai (2004), Diana and Perri (2010). In our study, conducted in Spain we took into account qualitative variables, and the purpose of this study was to explore the use of RRT for estimating the proportion related to bullying in Spanish students and to compare this value with the value obtained by direct question.

Method

Participants and Sampling Method

The sample for this survey included students from university of Granada. A stratified sample of students enrolled in different faculties were selected such that degree programs and year of degree were represented in proportion to their total numbers of students. The students were contacted in class and randomly assigned to one of the two survey modes: the RR technique (subsample 1) and direct responding (subsample 2). All questionnaires were administered during the class time break. All students were invited to participate in a study and provided informed consent by signed. The classroom setting facilitated cooperation, no objection to the survey was raised and no empty questionnaires were returned.

Sample Size Determination

From some efficiency and time constraints, we firstly decide to contact 500 students by direct questioning (DQ). The size of the RRT group was increased at a ratio of 1.5 to 1 (DQ) due to the lower statistical power of RRT than the DQ.

Procedure and Measure

The questionnaire is the same in two subsamples. This questionnaire began with some academic questions followed by a set of basic demographic questions and then a sensitive question referring to bullying. This screening test is a broad and comprehensive assessment designed to help researchers in the study of bullying.

In our case the sensitive selected question was: *Have you ever suffered bullying?*. In subsample 1 (using RR technique), for the sensitive question, the interviewer explained how the survey was being conducted, and gave an example of its use. The response was randomized using a generalization of the model proposed by Horvitz, Shah & Simmons, (1967) and extended by Greenberg, Abul-Ela, Simmons & Horvitz (1969). The randomizing device used was the app "Randomizers" with "Coin Flipper" option, which had previously been installed on the student‟s phone (Play Store, 2015). Figure 1 shows the app. The application is very simple to use, for the sensitive question the user touches the screen and a side of the coin is shown. If it is a face side, the sensitive question should be answered, if it is a tail side, the innocuous questions should be given. Figure 2 shows the procedure of response for the subsample 1.

Figure 1. App "Randomizers"

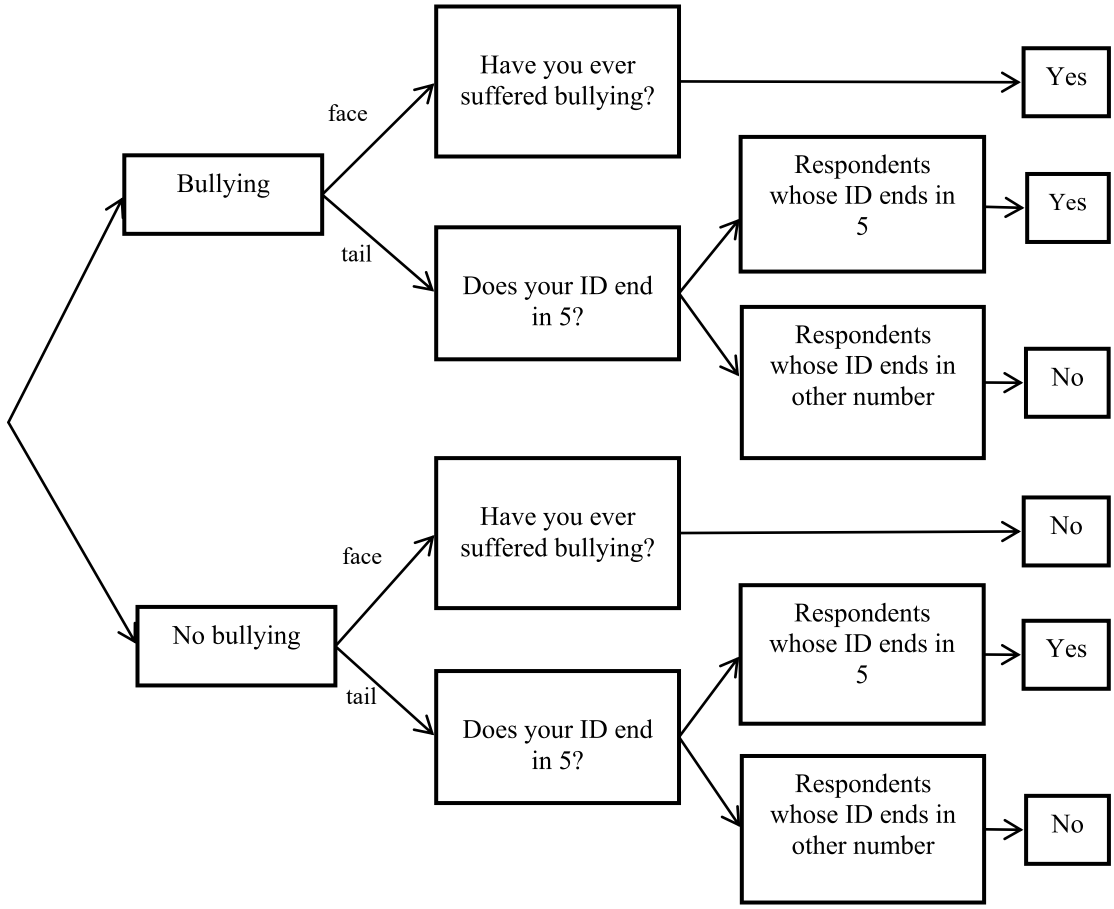

Figure 2. Response procedure of the respondent

The teacher explained that this technique preserved the students" anonymity with the aim not to provoke mistrust in them and all students completed the full questionnaire. On the contrary, in subsample 2 (using direct question), not all the respondents completed all the survey (the total nonresponse rate was 8%). The data collection and the field work were conducted by the research group FQM365 of the Andalusian Research Plan. The interviews were carried out during 2015, in Spain. Data were obtained from 754 students using RRT and from 492 using DQ.

Statistical Analysis

Inference in survey sampling is used to estimate the parameters of interest. The design weights were computed from a stratified clustered random design and modified for adjusting the bias of coverage. All statistical analyses were performed using the sampling weights. The Horvitz-Thompson estimator (Singh, 2003) was used to estimate the mean values for the direct questions. In RR the Horvitz technique was used to estimate the mean values of interest variable. All statistical analyses were perfomed using R software. We used some standard packages for estimation in survey sampling (Sampling; Tillé and Matei, 2015) and a specific package for handling RR data obtained from complex surveys (RRTCS; Rueda, Cobo and Arcos, 2015. Specifically, in this package we used the Horvitz() function).

Results and Discussion

The study was conducted for all students and also separating respondents by gender. In DQ, the survey had a population of 492 individuals, of whom 42.89% were men and 57.11% were women. In RR, the study population was composed of 754 students, with 39.79% men and 60.21% women. The point estimates of the sensitive variable and the corresponding 95% confidence intervals for each technique (DQ and RR) are summarized in Table 1.

Table 1. Estimation of the patterns of bullying

Study technique	DQ (n=492)				RR (n=754)			
	Estimation	Standard deviation	Confidence Interval (95%)		Estimation	Standard deviation	Confidence Interval (95%)	
			Lower bound	Upper bound			Lower bound	Upper bound
Total	0.1281	0.0058	0.1167	0.1395	0.2983	0.0315	0.2366	0.3601
Gender								
Male	0.1094	0.0048	0.1000	0.1188	0.2754	0.0343	0.2081	0.3426
Female	0.1268	0.0022	0.1225	0.1311	0.2591	0.0152	0.2293	0.2889

By DQ, the estimated prevalence of students who had suffered bullying was 13%, nevertheless according to RR, it was 30%. This difference is statistically significant. If we consider the results by gender, the prevalence of bullying is higher in the case of randomized response versus direct response for both men and women, being these differences significant. Focusing on DQ, the prevalence of bullying is higher in the case of female, and this difference is significant and focusing on RR, is higher in the case of men, but the difference is not significant. While RR is arguably less prone to bias than DQ, RR is also more susceptible to sampling variability.

Conclusion

The present study describes a survey asking sensitive qualitative questions about bullying in Spanish. The RRT was able to elicit higher values of self-stigmatizing reports of bullying by increasing privacy in the data collection process. The survey included 1246 students at the University of Granada. Respondents were randomly selected to use the RR technique and to be asked directly. On comparing the results of the direct survey and those of the randomized response survey, we find that the prevalence (DQ: 13%, RR: 30% aproximately) is much higher with RRT. This pattern is also obtained for men (DQ: 11%, RR: 28% aproximately) and for women (DQ: 13%, RR: 26% aproximately).

Thanks to these results we can conclude that men and women tend to hide that they have suffered bullying. If we look at the prevalence obtained in DQ, men have a lower prevalence than women, but if we look at the prevalence obtained in RR, men have a higher percentage than women, but since this difference is not significant, we cannot draw definite conclusions.

We propose the use of RRT for investigating bullying in order to produce an estimator with a smaller bias. We rose as this methodology would allow making more accurate estimates of self-report.

Acknowledgements

This work is partially supported by Ministerio de Economía y Competitividad (grant MTM2015-63609-R, Spain) and Ministerio de Educación, Cultura y Deporte (grant FPU, Spain).

References

Arnab, R., & Singh, S. (2010). Randomized response techniques: An application to the Botswana AIDS impact survey. *Journal of Statistical Planning and Inference, 140,* 941- 953.

S.K. Bar-Lev, E. Bobovitch, & B. Boukai. (2004). A note on randomized response models for quantitative data. *Metrika, 60*, 255-260.

R.F. Boruch. (1972). Relations among statistical methods for assuring con dentiality of social research data. *Social Science Research, 1*, 403-414.

Casas, J.A., Del Rey. R., & Ortega-Ruiz, R. (2013). Bullying and cyberbullying: Convergent and divergent predictor variables *Computers in Human Behavior, 29*, 580-587, 10.1016/j.chb.2012.11.015

Del Barrio, C., Martín, E., Montero, I., Gutiérrez, H., Barrios, A., and De Dios, M.J. (2008). Bullying and social exclusion in Spanish secondaryschools: National trends from 1999 to 2006. *International Journal of Clinical and Health Psychology 8,* 657-677.

J.L. Devore. (1977). A note on the randomized response technique. *Communications in Statistics-Theory and Methods, 6*, 1525-1529.

G. Diana, & P.F. Perri. (2010). A new scrambled response models for estimating the mean of a sensitive quantitative character. *Journal of Applied Statistics, 37*, 1875-1890.

Dietz P., Striegel H., Franke A.G., Lieb K., Simon P., & Ulrich R. (2013). Randomized response estimates for the 12-month prevalence of cognitive-enhancing drug use in university students. *Pharmacotherapy, 33,* 44-50.

B. Eichhorn, & L.S. Hayre. (1983). Scrambled randomized response methods for obtaining sensitive quantitative data. *Journal of Statistical Planning and Inference, 7*, 307-316.

S.A. Eriksson. (1973). A new model for randomized response. *International Statistical Review, 41,* 40-43.

El Español. (2017). https://www.elespanol.com/sociedad/20170427/211728988_0.html

Fox, J.A., & Tracy, P.E. (1986). *Randomized Response: A Method for Sensitive Surveys.* Sage, Berverly Hills.

Fox, J.P., & Meijer, R.R. (2008). Using Item Response Theory to Obtain Individual Information From Randomized Response Data: An Application Using Cheating Data. *Applied Psychological Measurement, 32,* 595-610.

Furlong, M.J., Greif, J.L., Bates, M.P., Whipple, A.D., Jimenez, T.C., & Morrison, R. (2005) Development of the California school climate and safety survey-short form. *Psychology in the Schools, 42 ,* 137-149, 10.1002/pits.20053

Goodstadt M.S., & Gruson V. (1975). The randomized response technique: a test on drug use. *Journal of the Acoustical Society of America, 70 (352),* 814-818.

Greenberg, B.G., Abul-Ela, A.L., Simmons, W.R., & Horvitz, D.G. (1969). The unrelated question RR model: Theoretical framework. *Journal of the American Statistical Association, 64,* 520-539.

Holbrook, A.L., & Krosnick, J.A. (2010). Measuring voter turnout by using the randomized response technique: evidence calling into question the methods validity. *Public Opinion Quarterly, 74,* 328-343.

Horvitz, D.G., Shah, B.V., & Simmons, W.R. (1967). The unrelated question RR model. *Proceedings of the Social Statistics Section of the American Statistical Association.* 65-72. Alexandria, VA: ASA.

Kerkvliet J. (1994). Estimating a logit model with randomized data: the case of cocaine use. *Australian Journal of Statistics, 36(1),* 920.

Kowalski, R.M., Giumetti, G.W., Schroeder, A.N., & Lattanner, M.R. (2014). Bullying in the digital age: A critical review and meta-analysis of cyberbullying research among youth. *Psychological Bulletin, 140,* 1073-1137, 10.1037/a0035618

Krumpal, I. (2012). Estimating the Prevalence of Xenophobia and Anti-Semitism in Germany: A Comparison of Randomized Response and Direct Questioning. *Social Science Research, 41 (6),* 1387-1403.

Kuha, J., & Jackson, J. (2014). The item count method for sensitive survey questions: modelling criminal behavior. *Journal of the Royal Statistical Society: Series C, 63 (2),* 321-341.

A.Y.C. Kuk. (1990). Asking sensitive questions indirectly. *Biometrika, 77*, 436-438.

Lara, D., García, S.G., Ellertson, C., Camlin, C., & Suárez, J. (2006). The measure of induced abortion in Mexico using random response technique. *Sociological Methods & Research, 35,* 279-301.

N.S. Mangat, & R. Singh. (1990). An alternative randomized response procedure. *Biometrika, 77*, 439-442.

Olweus, D. (1993). *Bullying at school: what we know and what we can do*. Blackwell, Oxford, UK; Cambridge, USA.

ONG Bullying Sin Fronteras. (2018). https://bullyingsinfronteras.blogspot.com.es/2017/05/estadisticas-de-bullying-en-espana-mayo.html

Ortega, R., & Fernández, I. (1998). *Violencia, agresión y disciplina. Prevención de la Violencia y Resolución de Conflictos. El clima escolar como factor de calidad,* Narcea Ediciones, Madrid, pp. 19-29

Ortega, R. (2010). *Agresividad injustificada, bullying y violencia escolar*. Alianza Editorial, Madrid.

Ostapczuk, M., Moshagen, M., Zhao Z., & Musch, Z. (2009). Randomized Response Technique: Evidence for the Importance of Response Symmetry. *Journal of Educational and Behavioral Statistics, 4 (2),* 267-287.

Play Store (2015). Download the application "Baraja Española". https://play.google.com/store/apps/details?id=cartas.barajaes.

Rueda, M., Cobo, B. & Arcos, A. (2015). Package „RRTCS": Randomized Response Techniques for Complex Surveys. http://cran.r-project.org/web/packages/RRTCS/.

Singh, S. (2003). *Advanced Sampling Theory with Applications. How Michael 'selected' Amy*. Springer, Netherlands.

Slonje, R., Smith, P.K., & Frisén, A. (2013). The nature of cyberbullying, and strategies for prevention. *Computers in Human Behavior, 29*, 26-32, 10.1016/j.chb.2012.05.024

Striegel H., Ulrich R., & Simon P. (2009). Randomized response estimates for doping and illicit drug use in elite athletes. *Drug and Alcohol Dependence, 15,* 230-232.

Tillé, Y. & Matei, A. (2015). R Package sampling: survey sampling, pp 76. Available from: https://cran.r-project.org/web/packages/sampling/sampling.pdf.

Tokunaga, R.S. (2010). Following you home from school: A critical review and synthesis of research on cyberbullying victimization. *Computers in Human Behavior, 26* , 277-287, 10.1016/j.chb.2009.11.014

Warner, S.L. (1965). RR: A survey technique for eliminating evasive answer bias., *JASA, 60,* 63-69.

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ISRES Publishing

The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 276 - 283

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Impact of Internship Programme in Engineering Education

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Abstract: A common opinion suggests that a distinction is somehow developed between the competence of engineering graduates and elemental requirements of the industry. Consequently, many universities in various countries have adapted internship programmes or industrial placement for some of their degree programs. This approach is also accepted and supported by many potential employers in different fields. Internships and placements are a kind of work experience obtained during the undergraduate years. Thanks to internship, the practical knowledge and understanding of students are greatly improved, especially in engineering education. It provides students with an opportunity to gain valuable working experience in their specific field and to enhance their prospects for future employment and engineering career before their graduation. This study is an attempt to evaluate the impact of such programmes on the basis of benefits and challenges. The evolution of internship programmes, alternative methods and basic principles are discussed. On the basis of the experience of Namik Kemal University, it is clear that this programme provides certain advantages for all sides but also many challenges. The students are introduced with the work life before graduation and has the chances of better preparation for the professional life. From the company point of view, they can make a very realistic assessment prior to the employment. The success of the programme depends on the level of co-operation and commitment displayed by internship students, partner companies and university academic staff. The involvement and commitment of students, support and capabilities of the factories outstands as important success criteria.

Keywords: Internship programme, Engineering, Engineering education, Training

Introduction

Various universities in several countries have already adapted internship programs or industrial placement for undergraduate programs. This approach is also accepted and supported by many potential employers in various disciplines. An internship is a kind of work experience which is achieved in the major field of student for one or two semester. In consideration of the fact that a distinction is somehow developed between the competence of engineering graduates and elemental requirements of the industry, Internships are extremely valuable for engineering students. Typically students participate in projects as they work alongside practicing industrial professionals as they tackle special day-to day challenges. Thanks to the internship program, the practical knowledge and understanding of students are greatly improved especially in engineering education. Internship programme in engineering provides students with an opportunity to gain valuable work experience in their specific field, and to enhance their prospects for future employment and engineering career before their graduation.

A certain period of practical training is integrated into engineering curriculums in many universities. The internship training may be optional or obligatory depending on the program concept. The internship is expected to focus on the relevant engineering discipline. It is believed to have positive impacts on all stakeholders with exception. On the other hand, interns on the field training may face some serious challenges. These are varied such as time limitation for the courses, unsupportive behaviour of companies, exaggerated enterprise privacy or cases with no pocket money or payment. The present study seeks to determine impacts of the internship means in engineering and attempts to raise questions to establish an ideal internship layout. A typical example of this method has been running at the department of textile engineering of the Namik Kemal University in Turkey since 2011. All final year students are required to take the internship procedure called as Sector Integrated

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

Education (SIE) for the last two semesters. Students are placed to several partner companies and take part in the program as intern engineers by attending three days per week for the entire semester.

Concept of Internship Programs

Previous works cited in the literature appear to be in agreement on the basic definition of internship. McMahon and Quinn (1995) state that internships are supervised work experiences whereby students leave their institutions and get engaged in work related programmes, during which period they are closely supervised by experienced job holders. According to Furco (1996), internships are defined as programmes engaging students in service activities primarily for the purpose of providing them with hands-on experience that enhances their learning or understanding of issues relevant to a particular area of study. In a relatively newer study, Tackett *et al* (2001), reported that internships have taken on an increasingly important role in education over the past decade since they provide students with many advantages, ranging from gaining experience and obtaining career-related direction to networking with other students from various institutions during the period of internship. The National Commission for Cooperative Education defined cooperative education as "a structured educational strategy integrating classroom studies with learning through productive work experiences in a field related to a student"s academic or career goals." (Groenewald, 2004). Internships are therefore any carefully monitored piece of work or service experience in which an individual has intentional learning goals and reflects actively on what she or he is learning throughout the experience or duration of attachment. Internships takes place during different times of the year: summer, winter or spring. These may be part-time or full time internships over different durations. Typical internships are entry-level, educational jobs that can be paid or unpaid and usually give one specific course credit for the work done.

Internship programs are believed to be developed as practical part of the Cooperative education which is a structured method of combining classroom-based education with practical work experience. Sovilla & Varty (2004) reported that a cooperative education experience, commonly known as a "co-op", provides academic credit for structured job experience and it started in the USA. The first cooperative education program in the USA was launched in 1906 at the University of Cincinnati with an enrolment of 27 students. This first program was in part inspired by the sandwich programs which may have existed in the United Kingdom since 1840 (Haddara & Skanes, 2007). About 50 years later than America, the first Canadian cooperative education program started at the University of Waterloo. The introduction of cooperative education programs in North America was mainly motivated by the needs of industry for better prepared engineers. The initial framework of cooperative education was defined by Herman Schneider who was engineer, architect, and educator (ceiainc.org n.d.). His approach concluded that the traditional learning space or classroom was insufficient for technical students. After trials in some technical colleges, Schneider devised the idea of cooperative education and it was launched at the University of Cincinati and became an immediate success. This approach gradually gained popularity in the North American Universities and was spread out to many countries.

The first experience of such a scheme in Turkey was implemented by the TOBB Economy and Technology University in 2004 (Dogdu, 2010). A cooperative training period which takes place 3 trimesters in commercial or industrial workplaces was mandatory for all students, In 2008, Namik Kemal University launched a similar scheme for all Vocational High Schools students as a workplace training two days per week (Ozek, 2010). This program was revised for the engineering students in 2011 as Sector Integrated Education. Bahcesehir University started co-op education program in 2009 and Gaziantep University launched a similar program as intern engineering in 2012. Since then the interest and remodelling cases for industry oriented training for engineering students have been gradually increased. On the basis of internet searches, Çukurova, Sakarya, Toros, Selçuk, Türk Hava Kurumu, Celal Bayar and K.Maraş Sütçü İmam Universities have already adapted internship programs for engineering curriculum.

Although internships and coop employment are similar, they are not the same thing, even if people use these terms interchangeably. The basic differences between the co-op and internship schemes are the period of training, the extent of involvement in workplace and terms of payment. The co-op programmes are longer in period as 2-3 semesters, students are more involved in company routines and employer and always get paid as a trainee for the whole training period.

Assessment of Internship Programs

A number of surveys were designed to measure the "benefits incurred by the student interns". The result of a survey shows a strong indication that the students find the internship experience is "worthwhile and valuable" (Sovilla & Varty, 2004). In 1990‟s, Mengoni (1998) described the collaborative work leading to the establishment of 3-year Diploma degree between the university and industry in Milan, Italy. A survey was carried out for the large number of companies A critical point of survey disclosed the concerned availability of the companies for active participation in the teaching and training activities-with interventions that range from hosting training internships to providing access to laboratories, from equipment loan or donation to involvement of company personnel as active teachers.

In another survey, the level of satisfaction of mechanical engineering students at the University of Kettering was assessed by Nasr, Pennington and Andres (2004). It was stated that over 90% seemed to be satisfied with the level of supervision and the work environment, and over 90% believed that the assignments they were given during their work terms contributed to their professional development, while 87% of the respondents were satisfied with their work experience. Similar other surveys discuss the possible benefits for employers and institution. The results approves that the internship programs provide a source of pre professional staffing," and is used "as a postgraduate recruitment device by many companies.

A recent survey carried out by Ozek (2016), among all the partners of a similar program, called Sector Integrated Education (SIE), in the Namik Kemal University proved that the implementation of the SIE procedure appears to be highly important from many aspects for all parties. The assessment of collective questions confirmed that partner companies have produced the highest average score (as 3,714 / 5) while the average scores of the SIE students, graduates and academics varied between 3,464 and 3,272. The survey confirms all parties have almost agreed on the high impact of the SIE on engineering education, and it also found that it has certain benefits for the NKU students. The ranking and total scores of possible benefits and

Table 1. Average ranking Scores for the assessment of NKU SIE survey for all parties
(survey carried out among students, graduates, academics and companies, Ozek 2016)

QUESTIONS	STUDENTS	GRADUATES	ACADEMICS	COMPANIES	Total Score
Benefits and accomplishment of the SIE programme for students (rank between 1-5)					
Gaining practical experience	1 (24 %)	2 (22 %)	3 (21 %)	1 (29 %)	96%
Experiencing professional work life	3 (21 %)	1 (23 %)	2 (24 %)	3 (22 %)	90%
Professional field orientation	2 (22 %)	3 (20 %)	1 (25 %)	4 (15 %)	82%
Building up theoretical knowledge	4 (17 %)	4 (18 %)	4 (17 %)	2 (23 %)	75%
Improvement of engineering formation	5 (16 %)	5 (17 %)	5 (13 %)	5 (11 %)	57%
Benefits and accomplishment of the SIE programme for the partner company (rank between 1-5)					
Assistance in the completion routine operations	1 (26 %)	2 (22 %)	1 (27 %)	4 (18 %)	93%
Conduction of routine tasks and minor projects	2 (23 %)	1 (24 %)	2 (22 %)	3 (20 %)	89%
Recruiting as potential emloyee	3 (18 %)	3 (20 %)	5 (12 %)	1 (25 %)	75%
Improving the university and industry collaboration	5 (15 %)	4 (18 %)	3 (21 %)	2 (21 %)	75%
Considerable labour force assistance	3 (18 %)	5 (16 %)	4 (18 %)	5 (16 %)	68%
The impact of SIE on academic achievement of students					
Positive	59,0%	73,3%	66,6%	69,0%	67,0%
No consirable contribution	41,0%	26,7%	33,4%	31,0%	33,0%
Benefits and accomplishment of the SIE programme for the university (rank between 1-5)			ACADEMICS		
An opportunity of conducting industry based projects for students			1 (24 %)		
Industry & university collaboration for joint projects			2 (22 %)		
Improving the recognition of the department			3 (19 %)		
Enhanced and Industry oriented textile engineering education opportunity			4 (18 %)		
Understanding current state and basic aspects of text. companies			5 (17 %)		

Accomplishment of the SIE programme at the NKU Textile Engineering Departments is given in Table 1. The highest ranked outcomes are; Gaining practical experience for students, Assistance in the completion of routine operations for partner companies and An opportunity of conducting industry based projects for students from the university. It is also found that all partners have agreed that the impact of the SIE on academic achievement of students is positive which was rated as 67% in average.

An assessment of the practical training that was developed in the Electrical Engineering Department of the Technical University of Delft is made by Rompelman (2002). The work confirms that program was proven to meet the predefined educational objectives to a large extent. Another study by Smith & Monk (2005) reports a survey of the progress of participants in a year in industry scheme for A‟‟ level graduates in the UK typically aged 18/19. The scheme involves spending a supervised year in industry prior to a degree programme in engineering. The evidence shows that the year in industry: has a beneficial effect on the degree classification of the academically weaker participants, but little effect on the stronger. It also encourages all participants to take up further study; provides participants with a more positive picture of industry and engineering; but does not provide greater motivation to enter industry. These results can be interpreted in terms of the way young people weigh the benefits of different career paths. From this survey and the analysis presented, it is stated that „„the year in Industry is a worthwhile investment‟‟. Although there are specific benefits, like improved degree results amongst weaker participants, and there are also disappointments. Internship scheme gives students real world experience in a professional job setting, networking opportunities that significantly increase their ability to get jobs after graduation, and explore potential careers. The outcome of a study by Baytieyeh & Naja, (2012) concludes that employers seek engineering students with related job experience and use their internship programs to recruit entry-level talent.

The benefits and challenges faced by student interns at the Zimbabwe Open University are discussed in a paper [Bukaliya, 2012). The study focussed on Faculty of Science and technology and Faculty of Applied Social Sciences. The results showed that the majority of the students preferred the attachment programme because it exposed them to the real expectations of the world of work. However, a number of challenges such as the reluctance of some fulltime employees to disclose important information appeared to have negative effect on the effectiveness of the program.

Galvan and his collegues (2013) examined whether students‟ performance as interns and the number of internships they completed are significant in determining their employability in various labor-market conditions. The study analyzed the records of 1,184 graduates at a private Mexican university who had completed undergraduate degrees in business, design, and engineering as well as mandatory internships between 2006 and 2009. Variables found to have a positive impact and a strong significance on the probability of employment (in order of decreasing influence) were: an excellent performance as an intern, a high degree of social connections, and high admission score. Variables with a negative impact on employability and a strong significance on employment were the interaction between students having graduated from the engineering and technology majors and their performance as an intern. This study revealed that the performance as an intern played an important role on employment.

The Noel-Levitz Student Satisfaction Inventory (SSI) is one of the popular and valid instruments used to assess students‟ perception of teacher quality and other quality factors in institutions of higher education (Mazumder, 2013). These perceptions of quality and measures of student satisfaction are used to improve services in university surrounding. The Noel Levitz SSI is widely utilized in North America (Richardson, 2005). In the 2017 Annual Report (R.Noel Levitz, 2017) of the The Noel Levitz SSI, the question of “Internships or practical experiences are provided in my degree/certificate program.” is rated as high importance for four year degree and technical college students. In a recent SSI assessment for Cincinnati University students (University of Cincinnati, 2017), the importance of the question is rated as 78% and the satisfaction rate appears to be slightly better in comparison with the students of National Community Colleges.

Impacts of Internship on Engineering Education

In order to evaluate possible impacts of an internship or co-op scheme on an engineering curriculum, the following issues should be analysed and discussed from the views of all stake holders; student interns, academics and partner companies.

- How do students benefit from the internship scheme?
- What are institutional benefits of internships in engineering?

- What are the benefits of companies employing engineering interns?
- What challenges are faced by the three parties in the process instituting internship scheme for Engineering curriculum?
- Are initiatives at the state and institutional levels promoting and even mandating that engineering students have an internship experience being designed with attention to the evidentiary base?
- What are possible benefits and drawbacks of the scheme experienced by graduates?
- How can the challenges faced by intern student be overcome in order to make the internship programme more effective and attractive?

O'Neill (2010) attempted to discuss the question "Are internships high-impact educational experiences?" It was expressed that this question should be answered by individual campuses and departments in accordance with their intentions and perspectives but also in recognition of international work world. From the students point of view, several impacts are listed as;

- They are effortful.
- They help students build substantive relationships.
- They help students engage across differences.
- They provide students with rich feedback.
- They help students apply and test what they are learning in new situations.
- They provide opportunities for students to reflect on the people they are becoming.

Particular impacts of an internship scheme for all the stakeholders, based on the practice at the NKU and findings of the relevant studies on the literature are given as follows:

On the Students :

- Increasing understanding of classroom theory through practical experience
- Having an early opportunity to select the most suitable sub area of the major engineering discipline
- Gaining major-related work experience prior to graduation
- An opportunity of building up self confidence in a working environment
- Increasing the chance of employability for the current employer just after graduation.
- Earning an industry oriented engineering diploma which is highly valued by potential employers.

On the University and academic staff :

- Establishment of a continuous relationship and contact with many companies
- Improved relations with the sector companies and technical experts
- Having an opportunity to conduct joint projects with industry
- Enhancement in the department curriculum and practical training
- Improved reputation of the department and the university
- Potential of increasing the quality and quantity of incoming students

On the partner Companies :

- Utilization of extra skilled labour force
- Having an opportunity to conduct joint projects with university
- Recruiting potential employees
- Improved relations with the university
- Collaboration in enhancing the qualifications of potential engineering graduates

Suggestions for Planning an Internship Scheme for Engineering Education

The transition from university to an engineering career is critically important and highly complex for engineering graduates. Succeeding in this transition is not only a matter of finding a job; it is also a matter of functioning intelligently in a world in which the culture, behaviors and rewards are new for them. As stated by Gower and Mulvaney (2012) in a systematic approach for students to make the most of their internship experience, the attitude of students are very critical. If students do not approach the internship experience thoughtfully, understanding communicating their personal and professional goals, and recognizing the needs and goals of the other parties involved, it is likely that they will be less than satisfied at the conclusion of the internship.

A very recent research report by Hora and colleagues (2017) on "What do we know about the impact of internships on student outcomes?" reviews the present literature work and current practices. The key findings of this work are listed in seven headings. These seven key issues are given as the lack of rigorous field studies on student outcomes; a detailed and standardized definition for what constitutes an "internship" experience does not exist, the evidence is mixed regarding the effects of internships on employability over the long-term and little research exists about the effects of internship experiences on wages; few studies examine the relationship between the design characteristics and student outcomes; the importance of careful planning, institutional support systems, coordination between academic programs and job-site mentors, a large "stable" of employers willing and able to host interns, and careful attention to legal and ethical issues; Scaling up of internship programs should ensure adequate staff, funding, and willing participants are in place before creating internship programs at scale; the field needs rigorous mixed methods longitudinal studies that examine the impacts of specific internship characteristics on a variety of student outcomes.

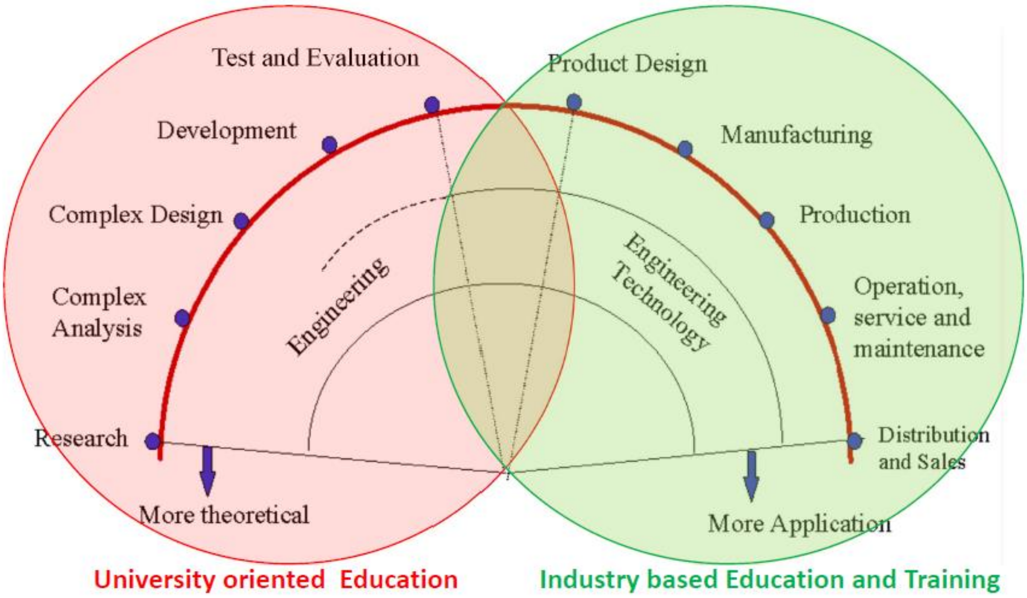

Figure 1. A comparison of the content of university and industry oriented education and training

Basic challenges and difficulties of the internship practice are usually dependent on the common understanding of the principles of the proposed scheme and the perception of specific role of each parties. These common challenges are as follows:

- Lack of specific framework to standardize the training activities
- Unfamiliarity with the SIE programme for many companies
- Wide variation between the partner companies
- Difficulty in planning and conducting of joint projects
- Reluctance of industrial supervisor and other technical staff to disclose technical information
- Less spare time for intern students
- Risk of extending the education period for poor students
- Limitation of the days allocated to the university class rooms (2 days per week) in the case of the NKU
- Hesitance of the companies to pay certain pocket money

Obviously, it is the responsibility of the university to assess whether the educational objectives are met. Internships should never be just an accumulation of periods working in companies. The prime educational objectives in planning of an internship or sector integrated education are :

- It must be intimately integrated with the academic components of curricula. As seen in Fig. 1, industry oriented training sessions should incorporate the practical aspects of the engineering discipline and technology.
- Internships terms, conditions and objectives must be linked to the skills already developed by the students, and accordingly, subsequent academic periods must take into account the internship outcomes,
- As a consequence, internships can be either searched by the university or by the student (as it is also something to be learnt) but, in the second case, the university must also verify the content and interest,

- The academic supervisor of students must be regularly informed about the internship progression so that he/she can help him to get more profit of the experience, and correct the eventual problems which may arise,
- Additionally, it should be utilized as an excellent opportunity in order to develop industry-academy relation.

Conclusion

The success of the program depends on the availability of a well designed internship or co-operative education program model. This was confirmed by a report prepared by the Turkish Universities Board (ÜAK, 2016). The report commented the shortcoming of the present models of internships as they were not based on a systematic project approach, while the importance of industrial training for engineering education is emphasized. The level of co-operation and commitment displayed by internship students, partner companies and university academic staff also appear as very important factors. The critical success factors are;

- existence of an appropriate framework for the internship scheme.
- assignment of responsibilities for student involvement,
- commitment of academic staff, and
- support and capabilities of the partnering companies.

The involvement and competency of students as well as the supportive behavior and capabilities of the partnering companies outstands as important success criteria for the internship program. In conclusion, the educational goals of the such schemes should be based on the following points:

- Accomplishment of acquiring insight into engineering profession and applied technology
- Enhancement of learning to apply as well as broadening technical knowledge and skills.
- Developing a common understanding and communication between all parties
- Social/psychological goals for student interns to learn surviving in a different culture and work environment.

References

Baytiyeh, H & Naja, M ; (2012), „"Identifying the challenging factors in the transition from colleges of engineering to employment, European Journal of Engineering Education, 37:1, pp.3-14.

Bukaliya, R, „"The Potential Benefits And Challenges Of Internship Programmes In An ODL Institution: A Case For The Zimbabwe Open University, International Journal on New Trends in Education and Their Implications, January, February, March 2012 Vol: 3 Issue: 1.

Cooperative Education & Internship Association, Inc. History of Cooperative Education and Internships Available from: http://www.ceiainc.org/about/history/

Doğdu, E (2010), Ortak Eğitim TOBB Ekonomi ve Teknoloji Üniversitesi Uygulamalı Eğitim Modeli Sunumu, Available from: www.ua.gov.tr/docs/erasmus-/13-calistay-staj-egitimi_tobb_etu.pdf?sfvrsn=0

Furco, A, Service Learning and School-to-Work; Journal of Cooperative Education, Vol:1, 1996, pp. 7-14.

Galvan J, Fisher E, Casman E and Small M (2013), Assessing the impact of mandatory internships on employability of recent college graduates in Mexico, Proceedings of the 2013 Conference for Industry and Education Collaboration, Session ETD 435, American Society for Engineering Education

Gower, R K, Mulvaney, M A, (2012), Making The Most Of Your Internship, A Strategic Approach, Sagamore Publishing LLC, Urbana, USA.

Groenewald, T (2004). Towards a definition for cooperative education. In R.K. Coll &. Eames (Eds.), International handbook for cooperative education: An international perspective of the theory, research and practice of work-integrated learning (pp. 17-25). Boston: World Association for Cooperative Education.

Haddara, M, Skanes, H; "A reflection on cooperative education: from experience to experiential learning", AsiaPacific Journal of Cooperative Education, 2007, 8(1), pp.67-76.

Hora, M T, Wolfgram M and Thompson, S, (2017) What do we know about the impact of internships on student outcomes? RESEARCH BRIEF #2 Centre for Research on College to Workforce Transitions (CCWT) and University of Wisconsin-Madison Wisconsin Center for Education Research.

Mazumder, Q. H. (2013), Student Satisfaction in Private and Public Universities in Bangladesh, *International Journal of Evaluation and Research in Education (IJERE)*, Vol.2, No.2, June 2013, pp. 78~84.

McMahon, U, & Quinn, U; (1995) Maximizing the hospitality management student work placement experience: A case study. Education and Training, Vol:37, p.13-17.

Mengoni, L & Sami, MG; (1998) Cooperation Between University and Industries in Organizing a „Diploma Universitario" Curriculum: The Politecnico di Milano-Assolombarda Experience, European Journal of Engineering Education, 23:4, pp. 423-429.

Nasr, K.J., Pennington, J., & Andres, C. (2004). A study of students" assessment of cooperative education outcomes. Journal of Cooperative Education, 38(1), 13-21.

O'Neill, N, (2010) "Internships as a High-Impact Practice: Some Reflections on Quality", Peer Review, Association of American Colleges & Universities, Fall 2010, Vol. 12, No. 4.https://www.aacu.org/publications-research/periodicals/internships-high-impact-practice-some-reflections-quality

Ozek, H Z (2010), Çerkezköy"de Üniversite, Kent Ve Sanayi Etkileşimi, Çerkezköy Değerleri Sempozyumu Kitapçığı, 20 Ekim 2010, pp.100-116.

Ozek, H Z (2016), Benefits And Challenges Of Internship Programme In Textile Engineering : A Case For NKU, 16th AUTEX World Textile Conference, June 8–10, 2016, Ljubljana, SLOVENIA.

Richardson, J. T. E. (2005), Instruments for Obtaining Student Feedback: a Review of the Literature, *Assessment and Evaluation in Higher Education*, Vol. 30, 2005, pp. 387-415.

Rompelman, O & De Vries, J; (2002) Practical training and internships in engineering education: Educational goals and assessment, European Journal of Engineering Education, 27:2, pp.173-180.

Ruffalo Noel Levitz (2017), 2017 National Student Satisfaction and Priorities Report. Cedar Rapids, Iowa: Ruffalo Noel Levitz. Retrieve from RuffaloNL.com/Benchmark.

Smith, N & Monk, M; (2005), „"An evaluation of the impact of a Year in industry scheme", European Journal of Engineering Education, 30:2, 2005, pp. 181-190.

Sovilla, E S, & Varty, JW ; (2004) „"Cooperative education in the USA, past and present: Some lessons learne"", International handbook for cooperative education: An international perspective of the theory, research and practice of workintegrated learning R.K. Coll &. Eames (Eds.), Boston: World Association for Cooperative Education pp. 316.

Tackett, J, Wolf, F, Law, D ; (2001) Accounting interns and their employers: Conflicting perceptions. Ohio CPA Journal, 60, pp.54-56.

UAK (Üniversiteler Arası Kurul) (2016) Türkiye"de Mühendislik Eğitim-Öğretiminin Niteliğinin Geliştirilmesine Yönelik Öneriler, Analiz, Şubat 2016 Sayı:1.

University of Cincinnati (2017), Un. Of Cincinnati Clermont College - SSI - 05/2017 Ruffolo Noel Levitz Student Satisfaction Inventory. Available from: http://www.ucclermont.edu/content/dam/clermont/Institutional%20Research/University%20of%20Cincinnati-Clermont%20College%20-%20SSI%20-%2005-2017.html

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 284 - 288

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Engineering Education Problems and Solution Suggestions

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Abstract: Engineering is to apply scientific and mathematical principles with technology for the benefit of mankind. The engineer must have certain theoretical and practical knowledge to be able to do his work, while the fundamental of theoretical knowledge is directly related to the knowledge of science and mathematics. Turkey's PISA score is far below the OECD average, ÖSYS results confirms this fact. For example, the net correct answered numbers of the questions the students who settled in the Department of Electronics and Communication Engineering of Namık Kemal University Corlu Engineering Faculty in 2016; For LYS1 Mathematics it is 16.9 for 50 questions, for LYS1 Geometry it is 7.7 for 30 questions and for LYS1 Physics is 5.5 for 30 questions. For evening education, the correct answers are as follows; 11.7, 4.3 and 4.1 respectively. ABET criteria and OSYS scores were examined and the reasons for the failure of students who settled in some engineering faculties were examined. In 2015, YÖK has initiated the practice of "restricting according to success" in engineering programs. In this study, it was concluded that the achievement rates of the students for the basic courses were compared with the OSYS success rank by taking the department as an example and it was inadequate to limit it according to success rank. In 2015, The Higher Education Council has started "The Application of The Restriction in Rank of Success in Programs for the Professional Execution". In this study, by taking NKU ÇMF, Department of Electronics and Telecommunication Engineering as an example, the success rate of the students for the basic courses are compared with the success rank of these students in the OSYS and it is concluded that the current method is not adequate for achieving the desired outcomes.

Keywords: Engineering education, Higher education

Introduction

Moving from the production centered society to information centered society makes essential for examining new production systems. The basic problem arising here is how to be considered of social parties opinions at taking changing decisions and solutions emerged from transformations. Education, a common known Notion by everybody is a future investment. This becomes real with modern university education (Akdeniz, 2001). Engineering education has a special role at creating the biggest value add in the development of a country.

Engineering is described as science application of turning natural resources for mankind use in the most appropriate way (EMO, 2012). In other words, it is application of technology for human help benefitting from scientific and mathematical principles. To make his job, an engineer needs some specific theoretical and practical information. The fundamental of theoretical knowledge is related to science and mathematics directly.
ABET (Accreditation Board for Engineering and Technology) in its revised report dated 20 October 2017 to accredited electric /electronics engineering programs declared its 2018-2019 criteria's as followings:

- Syllabus should supply graduates with demanded skills at electric/electronics systems designing, applying, installment, manufacturing, operating and /or care. Considered technical expertise related to varied electrical systems and unique aims of individual programs, some undergraduate programs can focus on deep but narrow masteries of others can choose training graduates in a various field expertise. For this reason, depth and width of expertise shown by graduates at undergraduate levels should be appropriate to support programs educational targets.

- Natural sciences, mathematics should be at algebra and trigonometry levels or higher than that and applied to electrics/electronics systems building, test, running and caring units.
- Control systems, instrumentation systems, communication systems, computer systems or power systems analysis the followings one or more, designing and application skills, applying ability of project management techniques for electric electronic systems; And to determine electrics/electronics systems performances, at least, abilities of differential and integral calculation skills should be obtained.

It is naturally expected for engineering education students adorned with science and mathematics to prefer this job. Whereas, in 2003 Science. Mathematics and Reading among OECD counties ranking were respectively 33, 35 and 35 and these rates regressed to 52, 49 and 50 in 2015. While Turkey's point 420, Mathematics reading average of OECD countries were 490 point. (MEB, 2015).

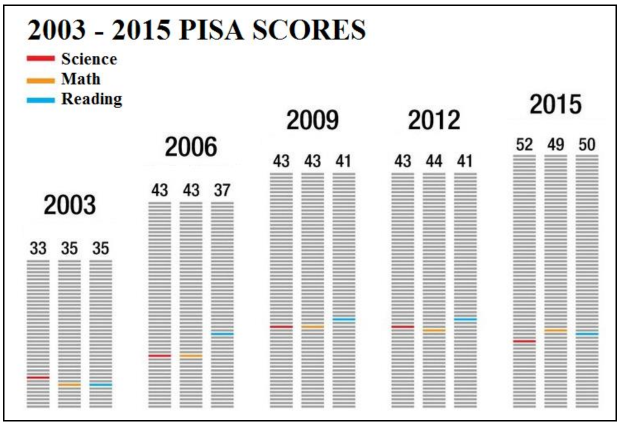

Figure 1. Mathematics, Reading and Science Turkey PISA Ranking in 2003-2015. (MEB, 2015).

It is obvious failure at higher education examinations when it was looked at PISA grades. In 2015, new YÖK (Higher Education Institution) made new arrangements receiving opinions of partners. In this context, limiting application according to success rates at the department's special to vocational performances was started. First, 40 thousand at medicine department 150 thousand success limit was determined and practiced in 2015 ÖSYS (student measuring and evaluating exam).With the same aim, meetings were made with the deans of engineering faculties. Same arrangements were done for engineering faculties as in medicine and law areas because of the ideas obtained from them. A success limit was regulated at engineering area as 240 thousand for this purpose.

2. An Example NKU Çorlu Engineering Faculty EHMB (Electronics and Telecommunication Engineering department).

At the EHMB department 2 professors, 2 associate professors, 1 assistant professor as teaching staff and 5 research assistant has been working. There are 335 undergraduates in formal programed and 310 in evening programmed. There are 41 master students. Students per teaching staff is 137. New branches cannot be opened because insufficient numbers of teaching staffs and running courses are becoming difficult more and more.

At Table 1 total net numbers at YGS/LYS of the students entered in 2016 formal and evening programs at Namık Kemal University Çorlu Engineering Faculty (ÇMF) Electronics and Communication Engineering Department (EHMB) are shown. (YÖK, 10.04.2017). It is inevitable that this table reflects negatively to all notional basic courses to be taken by students in his or her whole education career.

Table 1. Number of net questions answered by the EHM in 2016 YGS / LYS (YÖK, 2017).

Question Type	Number of correctly answered questions	
	Formal	Evening
YGS Turkish (40)	24,8	23,2
YGS social studies (40)	6,8	7,9
YGS Math (40)	22,5	19,5
YGS Science (40)	18,7	13,9
LYS-1 Math (50)	16,9	11,7
LYS-1 Geometry (30)	7,7	4,3
LYS-2 Physics (30)	5,5	4,1
LYS-2 Chemistry (30)	12,6	8
LYS-2 Biology (30)	8,2	5,4

2008-2016 LYS basic scores and placements were presented at Table 2. As seen from this Table 2 in 2008 EHBM took students from 27.000 and in 2016 took from 226.000. The success rate placed this department closed to 240.000 becoming upper limit for engineering in 2016.

Table 2. EHM base scores and rankings by years (YÖK, 2017)

		2017	2016	2015	2014	2013	2012	2011	2010	2009	2008
Base Score	Formal	268,28	273,833	288,827	304,45	319,613	359,064	409,009	426,971	315,5 (SAY 2)	317,417 (SAY 2)
	Evening	252,056	245,933	266,425	273,31	283,402	336,738	384,917	402,853	308,338 (SAY 2)	
Ranking	Formal		175.000	107.000	90.000	77.600	63.000	48.200	54.400	39.900	27.000
	Evening		226.000	143.000	126.000	93.700	80.200	64.700	64.600		

It is seen that EHBM basic scores and placements provided at Table 2 and success rates at basic notional courses according to the years of the students presented at Table 3 quite overlap.

For example, passing rates from the physics course at formal programed of the students entered 2008 is 68% and students entered 2015 is lowered to 11%.On the other hand, this rate decreased from 87% to 32% at the differential equation. This rate is available for basic vocational courses with the same periods. As it can be understood from Table 3 Fundamentals of Electric Circuits from 65% to 13%, digital design from 97% to 22%, Basic Electronics Circuits from 86% to 24%, automatic controls systems from 95% to 45%. Although it is perceived success rates are high at evening programed, some courses and years, it is understood from Table 3 that passing rates are lower than many courses in formal programed.

Decreasing passing rates, if students took courses beforehand, they do not have to attend class conditions increased student numbers in the classes. For instance, the department capacity is 60 students but at many courses numbers of students registered to those courses with evening programed beyond 350. Numbers of students in the class reality should be 25-30 is so unrealistic compared students' numbers receiving engineering education here. (YÖK, 10.04.2017).

Result

Though placing as to success application is evaluated positively, 240.000 limit is so low limit scale for engineering education. This limit should be arranged as 100.000 as soon as possible and make other arrangements for different engineering disciplines.

According to, EMO (The Chamber of Electrical Engineers) in 2016, engineering employment and vocational area research, unemployment rate escalated at Electrical, Electronics, Electrical-Electronics, Telecommunication and Biomedical Engineering and made public announcements for reasons of this situation and shared detections on this issue the followings:

Table 3. The success rates of the EHM in some courses over the years.

CODE	COURSES	2008-09	2009-10		2010-11		2011-12		2012-13		2013-14		2014-15		2015 - 16	
		Formal	Formal	iÖ	Formal	iÖ	Formal	iÖ	Formal	iÖ	Formal	iÖ	Formal	iÖ	Formal	iÖ
EHMB101	Introduction to Electronic Engineering	71%	88%	79%	82%	76%	70%	75%	63%	56%	64%	75%	84%	81%	71%	77%
FZK107	Physics I	68%	80%	79%	76%	85%	74%	31%	73%	61%	55%	38%	45%	15%	11%	8%
KMY004	General Chemistry	84%	87%	86%	87%	98%	95%	83%	72%	54%	47%	43%	48%	36%	53%	38%
LIC001	Linear Algebra	90%	93%	96%	82%	100%	75%	92%	68%	73%	67%	80%	65%	41%	61%	64%
MAT113	Mathematics I	65%	94%	96%	92%	95%	67%	75%	59%	89%	81%	80%	52%	58%	49%	33%
TBT001	Basic Information Technologies	90%	86%	89%	81%	79%	83%	52%	65%	59%	71%	66%	56%	79%	73%	81%
EHMB106	Computer Programming	48%	87%	86%	72%	34%	57%	32%	97%	94%	38%	21%	35%	47%	31%	31%
FZK108	Physics II	90%	88%	54%	85%	55%	86%	49%	81%	57%	51%	22%	3%	14%	13%	22%
MAT114	Mathematics Iı	74%	97%	93%	93%	90%	87%	68%	76%	70%	68%	77%	13%	3%	59%	47%
EHMB102	Fundamentals of Electrical Circuit	87%	65%	57%	70%	61%	94%	54%	56%	37%	29%	26%	24%	28%	13%	15%
EHMB207	Digital Design		97%		28%	60%	64%	52%	100%	57%	62%	48%	60%	50%	22%	39%
EHMB209	Circuit and System Analysis		90%		72%	71%	77%	75%	75%	68%	66%	41%	56%	52%	45%	45%
MAT202	Differential equations		87%		86%	33%	82%	70%	75%	54%	65%	74%	35%	13%	32%	33%
SYA002	Numerical Analysis		97%		89%	90%	50%	26%	72%	61%	93%	94%	39%	29%	24%	31%
EHMB202	Signals and Systems		39%		42%	19%	60%	35%	50%	37%	25%	28%	42%	41%	48%	64%
EHMB206	Electromagnetic Field Theory		97%		61%	53%	100%	85%	65%	78%	53%	57%	58%	53%	27%	30%
EHMB208	Basic Electronic Circuits		86%		77%	65%	93%	55%	51%	54%	43%	32%	36%	31%	24%	12%
EHMB301	Analog Communication				71%		76%	65%	100%	75%	48%	52%	41%	38%	42%	39%
EHMB303	Electronic Circuits				96%		63%	68%	38%	38%	31%	41%	55%	53%	59%	53%
EHMB305	Microwave				93%		75%	81%	67%	97%	50%	82%	74%	81%	76%	85%
EHMS 323	Electromagnetic Wave Theory				93%		91%	100%	90%	94%	83%	87%	48%	57%	84%	71%
EHMB302	Digital Communication				93%		100%	100%	90%	91%	60%	85%	55%	28%	52%	48%
EHMB 306	Digital Signal Processing				79%		67%	94%	84%	70%	30%	49%	56%	51%	56%	43%
EHMS312	Antenna and Propagation				90%		96%	100%	78%	97%	67%	92%	68%	67%	87%	85%
EHMS314	Communication Theory				72%		69%	74%	53%	68%	68%	76%	84%	81%	69%	70%
EHMB304	Automatic Control Systems								95%	90%	35%	98%	40%	50%	45%	48%
EHMB405	Mobile Communication Systems I								100%	100%	86%	83%	63%	92%	73%	65%

According to, EMO (The Chamber of Electrical Engineers) in 2016, engineering employment and vocational area research, unemployment rate escalated at Electrical, Electronics, Electrical-Electronics, Telecommunication and Biomedical Engineering and made public announcements for reasons of this situation and shared detections on this issue the followings:

- Our country remained fall behind so much of the technological development.
- Our country is not a producer but it is a market.
- Preferring economic growth model unable to create jobs for boosting young population.
- Rising numbers of engineering graduates.
- Effecting engineer’s employment of privatization and marketing on electrical and telecommunication areas especially cause young engineers to be unemployed.
- Even foresights for employment run with planning contexts cannot be done any more with closed state planning organization.
- The young carry on registering to engineering faculties with great expectations and after graduation they meet unemployment dilemma.

EMO’s suggested solutions for this issue (EMO, 2017) are the followings;

- Strategical planning and creating policies are needed to help technological improvements of our country with pioneered science and mind.
- Making urgent educational and employment planning are necessary at Electrical, Electronics, Telecommunication and Biomedical Engineering.

Above mentioned identified and suggested solutions are completely true. In addition to these, the followings should be added:

- On top of the problems financing of universities becomes first. Contribution margin to secondary education with general budget a higher education contribution margin foundation should be generated. (Akdeniz, 2003).
- Arranged rights to universities from general budget should be raised. Although numbers of universities, faculties, vocational colleges and students expand every year, reserved allowances for higher education decline year by year proportionately. For example, in 1993 0.90% of the GNP, 4.1% of the budget were reserved for higher education. In 1999, 0.84 % of the GNP, 2.8% of the budget were able to allotted for higher education. 2000 fiscal year budget law 0.80 % of the GNP, 2.2% of the budget designated for higher education. (YÖK, 2000). Even though with 15.9 % raise in 2016, 1.05 of the GNP, 4.6 % of the budget were allocated, this amount is not enough yet. (BUMKO,2017).
- Engineering departments should not be introduced without making essential infrastructure laboratories and teaching staffs.
- Privileges should be supported and infrastructures should be renovated at certain periods for updated technologies.
- At the state universities among total 6.137.014 students, there are 1.290.760 registered students in formal programme undergraduate studies and there are 420.705 registered students in evening programme at undergraduate studies. For the total 1.711.465 students, 21.834 professors, 14.481 associate professors and 31.130 doctor teaching staff total 68.445 teaching staff, 43.352 research assistants carrying on education and teaching too. (YÖK, 18.04.2017). Even if numbers of students to be 25 quantitatively with these numbers per teaching staff,there are unstable sharing situations among various disciplines against engineering faculties.Numbers of students per teaching staffs should be lessened to this ratio at engineering faculties as well.
- Although YÖK practised teaching staff education programme in different years, it will take long years to fill in missing numbers of teaching staffs. Because of the low income policy,teaching staff occupation lost its appeal and academic life should be made attractive for gifted and accomplished students.
- The critical circumstance to catch sustainable development at higher education is upsurging numbers of teaching staffs offering higher education. In spite of huge increase at numbers of teaching staffs and doctorate graduates, there are two significant problems. The first one: teaching staff focus on big cities. This occasion constitues imbalanced proportions among programmes, departments and faculties based teaching staffs. Besides,emerging instabilities influence both quality of the education and diminish capacity of teaching staffs with over load courses. Secondly, There are imbalances at delivering teaching staffs based on faculties, departments and programmes. (Öze, 2011).
- The top restriction should be 50.000 for Electrical, Electronics, Electrical-Electronics, Telecommunication and Biomedical Engineerings.

Unless afore mentioned expectations should be met, there will be enormous unemployed engineers crowd in the near future. Moreover, sources of the country will be used in vain and students wishing to be engineers with great enthusiasm for engineering will lack of notional science and mathematic information.

References

ABET. (2017). *2018-2019 Criteria for Accrediting Engineering Technology Programs.*

Akdeniz, R. (2001). Devlet üniversitelerimizdeki Temel Sorunlar Üzerine, *Cumhuriyet Bilim Teknik,* Sayı: 739, Sayfa: 17-19. (in Turkish)

Akdeniz, R., Aydın, H. (2003). Meslek Yüksekokullarına Sınavsız Geçiş: Sorunlar ve Çözüm Önerileri. II. Ulusal Meslek Yüksekokulları Sempozyumu, Sayfa:1-6, Ege Üniversitesi, İzmir, 15-17 Ekim. (in Turkish)

BUMKO, (2016). 2016. Yılı Merkezi Yönetim Bütçe Gerçekleşmeleri ve Beklentiler Raporu. (Erişim Tarihi:18.04.2017).http://www.bumko.gov.tr/TR,916/merkezi-yonetim-butce-gerceklesmeleri-ve-beklentiler-raporu.html (in Turkish)

EMO, (2012). EEBB İş Alanları, Elektrik-Elektronik-Bilgisayar-Biyomedikal (2012), EMO Yayın No:GY/2012/11, ISBN:978-605-01-0324-3. (in Turkish)

EMO, (27.03.2017). Elektrik Mühendisleri Odası Basın Açıklaması, EMO 2016 Yılı Mühendislik İstihdamı ve Mesleki Alan Araştırması. (in Turkish)

MEB, (2015).Uluslararası öğrenci değerlendirme programı, Pisa 2015 Ulusal Raporu, ISBN:978-975-11-4337-2 (in Turkish)

Öze, M. (2011). Türkiye'de yükseköğretimde büyüme ve öğretim üyesi arzı. *Yükseköğretim ve Bilim Dergisi*, Cilt:1, Sayı:1, Sayfa:23-26, E-ISSN:2146-5967. (in Turkish)

YÖK, (10.04.2017). https://yokatlas.yok.gov.tr, (Erişim Tarihi:10.04.2017) (in Turkish)

YÖK, (13.12.2015). Basın ve Halkla İlişkiler Müşavirliği Duyurusu. (in Turkish)

YÖK, (2000). *Türk yükseköğretiminin bugünkü durumu.* Ankara. YÖK. (in Turkish)

YÖK, (18.04.2017). Yükseköğretim Bilgi Yönetim Sistemi, (Erişim Tarihi:18.04.2017). https://istatistik.yok.gov.tr (in Turkish)

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 289 - 294

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

A Miniature Smart City Experimental Set for Engineering Education

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Abstract: This paper introduces a miniature experimental set demonstrating a smart city and its components for engineering education. The model prototype simulates the real life loads and energy sources in a small lab scale, employing the ZigBee communications and power control modules for many use cases in a typical smart city. The grids become smarter with the increase of renewable energy systems' usage, distributed energy production, and the availability of control and communication technologies on power grids. Therefore the education institutions take actions to educate the students on the state of the art smart grid components. As a part of this goal, the miniature smart city model was developed and some interactive software applications have been embedded to mimic the real smart city applications for engineering education.

Keywords: Smart city, Smart grid, ZigBee, Wireless control, Laboratory equipment

Introduction

Emerging technology, economical structure and modern daily life require us to use resources more efficiently, organized and controlled. An important part of this advancement which has become a basic need of human life in the last century, is production, distribution and consumption of energy with high efficiency. International researches have been done on this topic and technology is being developed to shows us the fact that, the advancement is following a path to "Smart City" concept, where energy is produced by renewable resources, all the energy flow is monitored though the "Smart Grid" infrastructure and energy consumption is made efficient by controlled usage and efficient equipment (Fang, Misra, Xue, & Yang, 2012). Smart grid components need to be studied in detail. In this paper, communication component will be highlighted and a short range communication standard will be employed in a model prototype. Brown (2008), defines a successful smart grid by its aspects which are, self-healing, high reliability and power quality, resistance to cyber-attacks, accommodating a wide variety of distributed generation and storage options, optimizing asset utilization, minimizing operations and maintenance expenses. These all are essential for smart grid system and making these able to synchronize themselves and inform results and problems.

Smart grid systems are in need of an advanced communication infrastructure with safe and reliable information exchange. Gungor et al. (2012) survey different types of communication technologies and methods in a smart grid system and discuss their effectiveness and usage areas. In this paper the ZigBee protocol was implemented for smart city communications in this experimental education set. As known ZigBee protocol is one of the most appropriate communication infrastructure for home automation, its low range and low data transfer rate make it less favorable in extensive use. Even though ZigBee has these down sides, its ability of mesh networking, low energy consumption and low price makes it advantageous (Masica, 2007). As ZigBee is convenient for home automation systems and applications, Han and Lim (2010) and Grill, Yang, Yao and Lu (2009) have also studied this concept.

As summarized above, there are several research and demonstration studies in literature. In this work, it is intended to cover most of these important items for a Smart City and demonstrate a simulation platform for higher education. The idea of using this type of experimental set is very useful in education since the students

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

can visualize and understand the concepts better, as also demonstrated by Chowdhury et al. (2013). The smart city model presented here simulates real life loads such as residential houses, schools, industrial premises, social and cultural sites, and public parks. It employs solar energy panels and wind turbines as the energy sources to feed these loads. Wireless communication technologies and power electronics hardware were installed for smart energy management to monitor and control of renewable energy sources and loads. This demo simulation platform as seen in Figure 1 has been being used at a university in Istanbul for the engineering education, which helps students to learn many concepts in a Smart City.

Figure 1. Miniature smart city

Method

There is a big energy cycle with energy production, transmission, distribution, energy converters etc. The best way to increase the efficiency is to adapt new technologies to these systems, monitor their conditions and control. To control and monitor, there are three layers which are the controlled system, the communication layer and the controller, as described in the chart of Figure 2. In this paper, systems and methods which are used to build a miniature smart city are surveyed first, then the control and communication technologies are discussed.

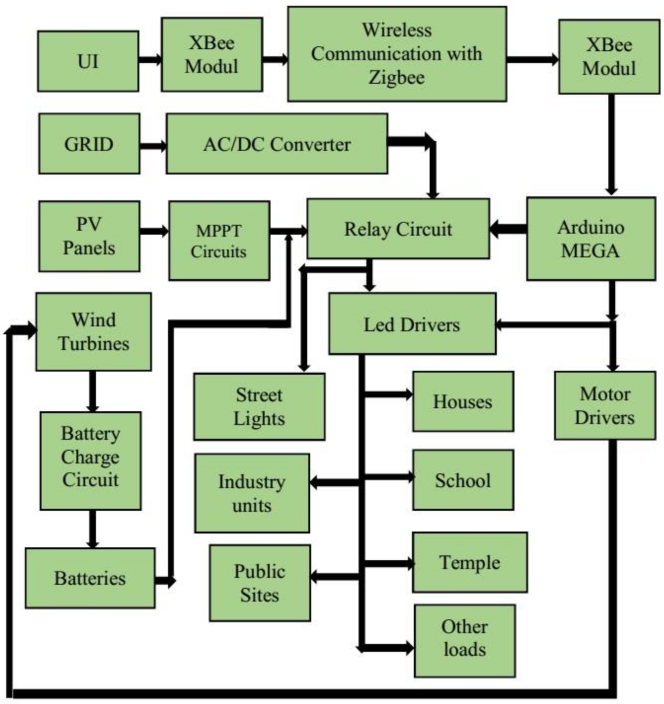

Figure 2. Energy management flow chart

Energy Cycle in the Smart City

In order to mimic a smart city, our miniature model needs energy sources. For this purpose two most common renewable energy sources are chosen as solar and wind. For solar power, four of 5W PV (photovoltaic) units are used with florescent luminaries over them and MPPT (maximum power point tracking) circuits are placed after PV panels to regulate output voltage and to limit output current. As the second means of energy production, five wind turbines are simulated via coupled motor-generator groups. Each of these groups are consisted of two 12V, 8W brushed DC (direct current) electrical machines. Motors in the groups are driven via PWM (pulse width modulation) controlled motor driver circuits and outputs of the generators are routed to battery charge circuits for voltage regulation and current limiting then used to charge battery groups. Also an additional 12V, 280W power supply is used to supply circuits, wind turbine motors and other parts of the system.

The energy efficiency is vitally important and it is best achieved at the consumer level. Using efficient end devices, monitoring and control of energy consumption are the key components for this purpose. In the miniature model, thirteen 12V, 1W power LEDs (light emitting diodes) are used as home and industrial loads. LEDs are powered via PWM controlled LED drivers to simulate different loads in different times of a day under different weather conditions.

The fundamental component of monitoring and control is measurement. In the model voltage and current of both production and consumption are measured via sensors, and then converted to digital data via ADCs (analog to digital converters). These values of voltages and currents are used to calculate instantaneous power values of all production and consumption components.

Communication, Monitoring and Control of the Smart City

In this prototype, wireless communication modules have been used for monitoring and control purposes. As this paper is about a miniature *Smart City* with a miniature *Smart Gird* infrastructure; all measurements, monitoring, control and communications are designed in a small scale demonstration test bench. The real life loads are scaled down on this test platform, maintaining the ratio of load profiles relatively.

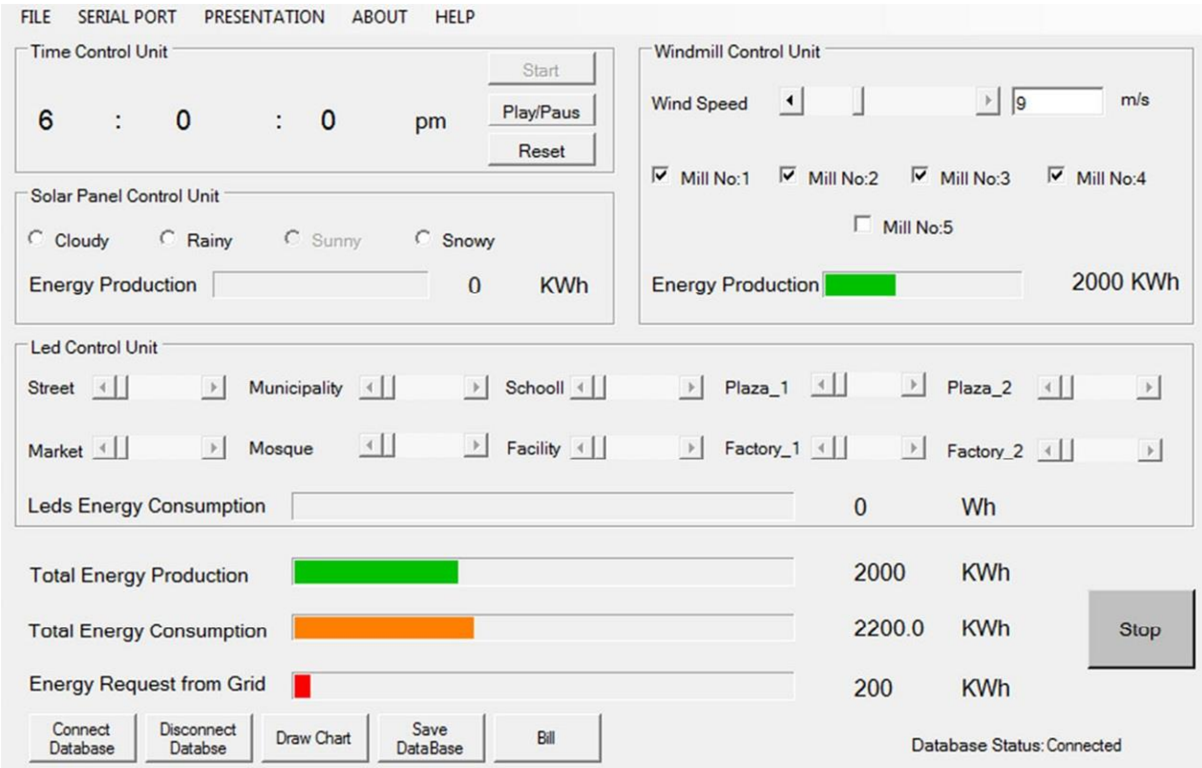

Figure 3. User interface for monitoring and control

ZigBee Protocol and Xbee Modules

ZigBee is a wireless network protocol standardized with IEEE 802.15.4 which supports different network topologies. ZigBee is mostly used for home or building features. A commercial module in market, XBee, is a low power consuming, short ranged, low data rated and low cost wireless network module which operating with ZigBee protocol. Its typical line-of-sight (LoS) range is up to 100 meters. It supports mesh network infrastructure which allows XBee modules to communicate over each other (Masica, 2007). In this project XBee modules are used to establish communication between the miniature city components and computer which enables monitoring and control of the system.

Monitoring and Control via User Interface, Computer and Arduino

For monitoring and control purposes a computer which has a UI (user interface) as shown in Figure 3 is used. Through this UI instantaneous power values can be monitored and different parts of the miniature city can be manipulated. Infrastructure of the miniature city is controlled by Arduino Mega 2560. With XBee modules a communication layer between computer and Arduino is established. Manipulation through the user interface is translated into sub-protocols which then sent to Arduino for execution. Execution is done as opening or closing relays, or setting PWM values for drivers. Arduino also collects information from the infrastructure of the miniature city via sensors. These are instantaneous voltage and current values from different parts of the system such as solar energy production, wind turbine production and different consumption data. Then Arduino sends these data to the computer via wireless communication for computing. Data received by the computer are used to calculate instantaneous power values of the system, and can be monitored from the UI.

Wireless Energy Transfer from Charging Station to Truck

To demonstrate the wireless energy transfer technology a model truck, that follows a preset path on the road of the miniature smart city, is used. In each lap, truck stops in front of the charging station for a while. During that time wireless energy transmitter circuit in the charging station is activated, which, in turn, enables the wireless energy transmission via the coils that are both in the station and the truck. Energy is received by the truck and regulated by the wireless energy receiver circuit and used to light an LED on top as shown in Figure 4. Due to circuits and energies being small actual charging is not possible, however this application is quite satisfactory for teaching the fundamentals of wireless energy transfer.

Figure 4. Wireless energy transfer from charging station to truck

Results and Discussion

A miniature smart city simulation platform, which monitors and controls the integrated energy resources and loads, is developed and made ready for engineering education. It stores the power consumption of the loads real-time for future reference.

The experimental set is made for students by the students to increase the understanding of fundamental subjects via applied demonstrations. The set is open for students to observe during working hours in Yıldız Technical University, Electrical Engineering Department's general laboratory. Students may get informed about the set by laboratory assistants and lecturers may use the set with student groups to reinforce theoretical topics they cover during lectures with applied demonstrations. Lectures that are planned to incorporate this experimental set are given in Table 1.

Table 1. Lectures that experimental set planned to be used in

Lecture Names
Introduction to Electrical Engineering
Electromechanical Energy Conversion
Electric Machinery
Electricity Generation
Renewable Energy System
Introduction to Smart Grids
Smart Home and Energy Management
Alternative Energy Sources and Modelling
Planning Feasibility of Renewable Energy Sources
Grid Integration of Alternative Energy Systems
Hybrid Alternative Energy Systems

Conclusion

The goal for building this miniature smart city model is to train the engineering students on the trending technologies in market and teach new topics such as smart city and smart grids, to create awareness on smart energy management, and to present the technologies and technics for communication design in a smart city environment. The model demonstrates many concepts for Smart City, including generation, monitoring, and control of power, embedded software, and communications. It is expected to help students with the smart city education in a laboratory environment.

The current experimental set is mainly in demo mode with certain capabilities. Enhanced features can be embedded. For example, a more interactive UI could be introduced for students to run in different configurations. Furthermore, the system may be augmented with cameras, remote control, and monitoring infrastructures.

Acknowledgements

We want to thank Panasonic Eco Solutions Inc. for supporting this project. Also TÜBİTAK (The Scientific and Technological Research Council of Turkey) for supporting us with the 2241-A Industrial Focused Bachelor Thesis Project Grant. And we would like to thank Melih BALLIKAYA, Murat DERİN, Yunus Emre ÖZNİŞASTACI, Arif Tuna UTKU, Arif ÜZGÜN, Z. Yağmur KOPARAN, and Tuğçe TALAY for their contributions to this miniature smart city.

References

Brown, R. E. (2008, July). Impact of smart grid on distribution system design. In *Power and Energy Society General Meeting-Conversion and Delivery of Electrical Energy in the 21st Century*, 2008 IEEE (pp. 1-4). IEEE.

Chowdhury, B., Parkhideh, B., Martin, A., Salami, Z., Enslin, J., Cecchi, V., & Maciej, N. (2013, July). Enhancing power and energy systems concepts with laboratory experience. In *Power and Energy Society General Meeting (PES)*, 2013 IEEE (pp. 1-5). IEEE.

Fang, X., Misra, S., Xue, G., & Yang, D. (2012). Smart grid—The new and improved power grid: A survey. *IEEE communications surveys & tutorials*, 14(4), 944-980.

Gill, K., Yang, S. H., Yao, F., & Lu, X. (2009). A zigbee-based home automation system. *IEEE Transactions on consumer Electronics*, 55(2) 422-430.

Gungor, V. C., Sahin, D., Kocak, T., Ergut, S., Buccella, C., Cecati, C., & Hancke, G. P. (2013). A survey on smart grid potential applications and communication requirements. *IEEE Transactions on industrial informatics*, 9(1), 28-42.

Han, D. M., & Lim, J. H. (2010). Smart home energy management system using IEEE 802.15. 4 and zigbee. *IEEE Transactions on Consumer Electronics*, 56(3) 1403-1410.

Masica, K. (2007). Recommended practices guide for securing ZigBee wireless networks in process control system environments. *Lawrence Livermore National Laboratory*, 6-8.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 295 - 298

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Impact of Teacher Candidates on Effective Use of Information by Identifying Web Pages Prepared for Social Studies

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Abstract: The goal of contemporary education is; is to train people who produce knowledge, who use knowledge, who have acquired continuous learning habits and who have the knowledge of creative nature. Today, the rapid development of computer and internet technology is the end result, it is inevitable to utilize these technologies in the field of education. Through web pages located in the internet world, individuals contribute to the development of research skills, critical thinking skills by sharing their works and ideas. This study was carried out in order to determine the effect of social studies teacher candidates on the ability to use the technology effectively by preparing a web page. This study was conducted using qualitative research techniques. The study group of the study was conducted with 20 students in total, with 5 teacher candidates for each grade level. The data were collected with these semi-structured interview forms. It was determined that prospective teachers used web pages effectively, obtained information by using search engines, learned application programs and got a critical view on technology in the obtained data. On the basis of the results obtained, suggestions such as the necessity of using web technologies in all courses have been made.

Keywords: Social studies teacher candidates, Technology, Web

Introduction

The goal of contemporary education is; is to train people who produce knowledge, who use knowledge, who have acquired a habit of continuous learning, and who have the knowledge of creativity. In today's fast-paced and changing world, individuals must be able to apply the information they have found to solve the problems they are facing, seeking ways to access information instead of memorizing and memorizing information from a single source (Birişçi & Metin, 2009). It is clear that individuals with such traits must be able to benefit from the environment in which they interact (Halis, 2002). We can refer to such interactive environments as environments where individuals will have access to information and will benefit from this information (Yiğit, Alev, Altun, Özmen & Akyıldız, 2006). Examples are computer and internet technologies, where individuals can easily reach, interact with each other, and can benefit from information they receive in the direction of their goals (Karahan & İzci, 2001).

Rapid developments in the field of science and technology bring about the necessity of questioning and developing the professional skills of teachers by influencing the dynamic of all dimensions of learning and teaching processes (MEB, 2006). In this direction of Turkey in order to enable teachers to use information technologies, including computer courses have been various attempts in the first place. Within the scope of many projects put into practice since 1985, it was aimed to train teachers in computer and computer aided teaching subjects through in-service training (Usun, 2009). At this point, although the teachers are willing to improve themselves on information technology (Scott, 2007), there are research findings that indicate that the desired level has not yet been achieved (Ulaş and Ozan, 2010; Yılmaz, 2007;). For example, Tezcan (2011), located in four different regions in Turkey from 18 cities in the comprehensive study conducted by teaching a total of 1540 working in 330 primary schools, schools of angles both in terms of motivation and technical concludes unreachable sufficient for the integration training of information technology (Sad & Nalçacı, 2015; Koçoğlu, 2014; Koçoğlu, 2015).

When the literature is examined, it is seen that how the developmental process of information literacy changes along with the developing technology, the knowledge transfer and research strategies differ at that point and it is necessary to have the ability to use these technologies in order to be able to become literate (Ata, 2011; Ulu Kalin, 2017a). The knowledge literacy self-efficacy 4 perceptions must also be developed so that university students and the teachers who educate them will feel adequate in this area, that is, they can use the information literacy skills they possess and use with confidence (Ata, 2011; Koçoğlu, 2013). The social structure of social media environments, as well as the various individuals, writers and readers that provide a network with different relationships and links, together with the personalization of content, information sharing and collaboration are also the basis of the social dimension (Bartlett Bragg, 2006; Ulu Kalin, 2017b). It is also stated that with social networks, only access to content has been removed from the limit, providing unrestricted learning where social practice experiences are constantly organized in shared environments of people (Mejias, 2005; Hacat, 2018a). However, it is not enough to emphasize the necessity of using Web 2.0 tools especially for foreign language teaching. In order for all of these to happen, the teachers of the language, Web tools need to be able to use it effectively. For this reason, teachers and prospective teachers who play a leading role in education are very important about their opinions and thoughts about Web 2.0 tools. More importantly, without entering the educational environment, it must be learned about how these tools are learned and how they can be used in educational settings (Özerbaş & Mart, 2017; Hacat, 2018b). In the light of this information, this study was carried out in order to determine the effect of social studies teacher candidates on the ability to use the technology effectively by preparing a web page. For this purpose, the following questions have been answered;

1.What are the opinions of the social studies teacher candidates regarding the instructional design of the website?

2.What are the views of social studies teacher candidates regarding the content of teaching presented on the website?

3. What is the recommendation of social studies teacher candidates to increase the effectiveness of the website?

Method

This section includes; the study group, the data collection tools, and analyzes of the data.

The desire of your research

The research is structured with a qualitative approach. In this study descriptive analysis was used from qualitative research types.

Working group

The data of this research are presented in Gaziantep University Nizip Education Faculty Social Studies Education Department 201-3-2018 fall semester 1-2-3-4. The 5 candidate teacher candidates selected for the class were carried out with a total of 20 people (10 girls - 10 boys).

Data Collection Tools

The data of the study were obtained by asking three open-ended semi-structured.

Analysis of Data

In this study, collected data were analyzed using descriptive analysis technique from analysis techniques in qualitative research methods. The purpose of descriptive analysis is to introduce a format in which raw data can be read and used by readers. The data obtained in the descriptive analysis are summarized and interpreted according to the previously determined theme. In this analysis, direct citation is often given in order to reflect the views of the individuals seen or observed in a striking way (Yıldırım and Şimşek, 2005).

Results and Discussion

Findings and Comments for the First Subproblem;

What are the opinions of the social studies teacher candidates regarding the teaching design of the web site? In spite of many questions, many of the prospective teachers have emphasized that they prefer to read the texts prepared for the research rather than reading the content on the screen. The website also had a feature that showed the latest content when it was entered on the page. Some students have stated that they are aware of this feature.

Findings and Comments for the second subproblem

What are the views of social studies teacher candidates on the content of the teaching offered on the website? Sorry for that, the teacher candidates Web site had 20-25 pages of content outlined in the resource book sections

for each topic. In addition, pre- and post-test questions, important points, and evaluation tests that led students to think about it were included. All content and structure teacher candidates have been noted to attract interest.
Findings and Comments for the third subproblem

What is the recommendation of social studies teacher candidates to increase the effectiveness of the website? Teacher candidates questioned that there are some points that prevent students from reading and printing on the screen. The majority of the students emphasized that the site should be visually supported more. In the context of using communication tools more effectively, students have emphasized the importance of discussing and sharing ideas in forums.

Conclusions and Recommendations

When literature related to web based learning is examined, almost all studies support the findings in this research. Findings show that the combination of pure online and traditional methods has a positive effect on the success of learners, their attitudes towards their lessons and their motivation. The results of the research show that to use web-based environments more effectively, technical specifications must be used and information should be presented in different formats. The results of the study show that there is no uniformity among individual preferences. The students expressed different expectations that were observed by the researcher throughout the semester. These preferences can change depending on the learning environment and time. In addition to individual preferences appearing to influence the use of materials and environments provided to students, the possibilities and tools provided by the tutor may also influence the teaching-learning process. In this case, the teacher also has tasks such as guidance and encouragement, which play an important role in the effective integration of the technology into the teaching-learning process. In the context of these findings, it can be said that the presentation and practice of information along with presentation of information in web based learning environments is an important element for more successful and permanent learning. However, there is no significant difference between web based environments when considering motivation and PC anxiety. With these results, it is possible to examine the anxiety and motivation scores for the computer between the classroom environment and the web-based environment by eliminating the data loss incompleteness in this study, and it can be seen that the satisfaction variable that affects the success is also the difference between these groups.

Acknowledgements

This work was presented at the International Conference on Education in Mathematics, Science and Technology (ICEMST).

References

Ata, F. (2011). Üniversite öğrencilerinin web 2.0 teknolojilerini kullanım durumları ile bilgi okuryazarlığı öz-yeterlik algıları arasındaki ilişkinin incelenmesi (*Doctoral dissertation, DEÜ Eğitim Bilimleri Enstitüsü*).

Bartlett Bragg, A., (2006). Reflections on Pedagogy: *Reframing Practice to Foster Informal Learning With Social Software,*

Birişçi, S., & Metin, M. (2009). Fen Konularına Yönelik Web Sayfası Hazırlama Öğretmen Adaylarının Bilgisayar Teknolojisini Kullanabilme Becerilerini Nasıl Etkiler?. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi*, *3*(2).

Hacat, S. O. (2018a). Assessment of the Basic Law Lesson Consistent with the Opinions of Social Studies Pre-Service Teachers. *International Journal of Higher Education*, *7*(1), 103-110.

Hacat, S. O. (2018b). Opinions of Middle School Students on the Justice Concept within the Framework of Social Studies Education. *International Journal of Higher Education*, *7*(2), 210.

Halis, İ. (2002). Öğretim Teknolojileri ve Materyal Geliştirme, Ankara: Nobel Yayın Dağıtım.

Kalın, Ö. U. (2017b). Analysis of 7 th Grade Social Studies Course Book According to Different Readability Formulas. *International Online Journal of Educational Sciences*, *9*(4).

Karahan, M., & İzci, E. (2001). Üniversite Öğrencilerinin İnternet Kullanım Düzeyleri ve Beklentilerinin Değerlendirilmesi, Milli Eğitim Dergisi, 150.

Koçoğlu, E. (2013). Sosyal Bilgiler Öğretmen Adaylarının, Okul Yöneticilerinde Olması Gereken Demokratik Tutum Ve Davranışlara İlişkin Algıları &60; Br&62; Social Studies Teacher Candidates Perceptions Of

School Principals Should Not Have Democratic Attitudes And Behaviours. *Turkish Studies*, *8*(6), 413-430.

Koçoğlu, E. (2014). Sosyal Bilgiler Öğretmenlerinin Sosyal Bilgiler Kavramına İlişkin İmgesel Algıları. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *15*(3).

Koçoğlu, E. (2015). Social Studies Teachers' Perspective of Religion Education in Turkey. *International Online Journal of Educational Sciences*, *7*(1).

MEB (2006). Tedp Temel Eğitime Destek Projesi "Öğretmen Eğitimi Bileşeni": Öğretmenlik Mesleği Genel Yeterlikleri. Millî Eğitim Bakanlığı Tebliğler Dergisi,69(2590), 14 91-1540.

Mejias, U., (2005). Nomad's guide to learning and social software,

Özerbaş, M. A., & Mart, Ö. A. (2017). İngilizce Öğretmen Adaylarının Web 2.0 Kullanımına İlişkin Görüş Ve Kullanım Düzeyleri. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *18*(3).

Sağlam, F. (2007). İlköğretim okullarında görev yapan öğretmenlerin derslerinde bilgi teknolojisi kaynaklarından yararlanma öz-yeterlilikleri ve etki algılarının değerlendirilmesi. Yayınlanmamış Yüksek Lisans Tezi Yeditepe Üniversitesi, İstanbul

Şad, S. N., & Nalçacı, Ö. İ. (2015). Öğretmen adaylarının eğitimde bilgi ve iletişim teknolojilerini kullanmaya ilişkin yeterlilik algıları. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, *11*(1).

Tezci, E. (2011). Turkish primary school teachers' perceptions of school culture regarding ıct ıntegration. Educational Technology Research and Development, 59(3), 429-443.

Ulaş, H., ve Ozan C. (2010). Sınıf öğretmenlerinin eğitim teknolojileri açısından yeterlilik düzeyi. Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 14(1), 63-84.

Ulu Kalin, Ö. (2017a). Creating Interactive Student Workbook for Primary Education Social Studies Class and Researching Its Efficiency. *Journal of Education and Practice*, *8*(12), 33-40.

Usun, S. (2009). Information and communications technologies (ICT) in teacher education (ITE) programs in the world and Turkey (a comparative review). Procedia Social and Behavioral Sciences, 1, 331–334.

Yıldırım, A. ve Şimşek, H. (2005) Sosyal Bilimlerde Nitel Araştırma Yöntemleri. (2. baskı). Ankara: *Seçkin yayıncılık*.

Yılmaz, M. (2007). Sınıf Öğretmeni Yetiştirmede Teknoloji Eğitimi. Gazi Eğitim Fakültesi Dergisi, 27(1), 155-167.

Yiğit, N., Alev N., Altun T., Özmen H., & Akyıldız, S. (2006). Öğretim Teknolojileri ve Materyal Geliştirme, Trabzon: Derya Kitap Evi.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 299-302

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Effect of Technology Assisted Micro Teaching Practıces on the Perception of Technology Usage of Social Studies Teacher Candidates

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Abstract: In the last decade, traditional programs applied in teacher education in the light of rapidly developing technological developments are no longer able to provide all necessary qualifications needed by the candidate teachers in meeting the 21st century community demands during the teaching process. In this respect, it is necessary to increase the related equipment and awareness of the students while they are teacher candidates in the period of teacher training which is in teaching profession and preparation. This work; The purpose of this study was to investigate the effect of technology assisted micro-teaching practices on the perceptions of social studies teacher candidates on technology usage. Qualitative research techniques were utilized in the research. The study group of the study consisted of 4th grade social studies teacher candidates (n = 45). The data were obtained using the semi-structured interview form. The data were interpreted with descriptive analysis technique. They found that knowledge about selecting or preparing technological tools for the use of intelligent boarding and lecture presentation was the most increased in the direction of findings from the research. As a result of technology-assisted micro-teaching practices, it has been seen that teacher candidates perceive themselves adequately for the use of technology and there is a slight increase in their perceptions after their implementation. In the light of the emerging conclusions, proposals are presented such that the courses containing these applications which contribute to the field of technology use in the classroom should be given more place in the teaching of social studies.

Keywords: Micro-teaching, Technology, Social studies teacher candidates

Introduction

Micro teaching was originally developed by a group of educators such as Dwight Allen, David Young, Robert Bush, and Frederic McDonald in the 1960s to enhance the quality of teacher education at Stanford University in the United States. The Stanford model consists of teaching, reflection and reflection, re-teaching stages, and involves the actual work of these students (Aydin, 2016; Koçoğlu, 2013; Koçoğlu, 2014). There is no doubt that it is no more than teachers who will train qualified students who will take their place in the globalizing world. The necessity of having a good university education so that teachers can answer this need adequately is a matter of debate. Various reform movements, both for the teacher training system and for the teaching processes, periodically emerged in the last century with the thought that the qualified education made by qualified teachers would be a positive reflection on the student's success (Karaman & Şahin, 2017; Koçoğlu, 2015).

When the related literature is examined, it is seen that teachers generally use technology and knowledge to fulfill their duties, prepare plans, transfer knowledge during teacher-centered teaching, make homework evaluations, prepare exam questions, communicate via e-mail (Seferoğlu & Akbıyık, 2005). In some researches (Usta & Korkmaz, 2010; Sancar Tokmak, İncikabi & Yanpar Yelken, 2012; Ulu Kalin, 2017a; Ulu Kalin, 2017b), it is noteworthy that teachers stated that the use of technology for teaching purposes is important but they can not use it effectively in the technological teaching process due to some obstacles. When this obstacle is considered, it is understood that teachers are in a negative attitude towards the use of technology, they can not understand the concept of integration of technology with teaching and they are not aware of technological progress (Çakır & Yıldırım, 2009, Seferoğlu, Akbıyık & Bulut, 2008; Hacat, 2018a).

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Smart boards are an innovative technology and are seen as a combination of white and black board computer technology in a traditional classroom environment and are a technology that helps improve both the effectiveness of the teacher and the quality of the teaching (Jang, Tsai, 2012). Today, different studies are being done on technology integration and especially on the use of intelligent board classrooms (Kennewell & Morgan, 2003, Warwick & Kershner, 2008, Tekelioğlu, Driver, Uğur, Dönmez, Ok & Eren, 2010; Hacat, 2018b).

Generally, a portable videotape recorder, a TV camera, and a videotape recorder microphone are needed to carry out micro-teaching sessions (Orlich et al., 1990). Effective use of video as a technology in teacher education and training approaches is important in terms of acquiring and developing qualities (Mccury, 2000). It is necessary to find a video in micro-teaching which is an important basis in teacher education (Kpanja, 2001). Watching video recording and skills is beneficial for teaching and it is a good method. Everyone in the group is paying more attention to behaviors and events while watching the video. Because at the moment of recording, maybe there are things that get away from your eyes. Watching again is useful for generating more questions and ideas on the recordings (Higgins & Nicholl, 2003). Joshi (1976) notes that video recordings help basic learning skills advance their learning. Olivero (1970) notes that micro-teaching without video recordings is less effective in acquiring skills, because the candidate has reached the conclusion that he lacks the opportunity to see teacher mistakes (Kpanja, 2001). The retraining of the micro-teaching session has great potential in helping to identify strengths and weaknesses while using special teaching approaches and strategies. The follow-up and student feedback is intended to help you become the best teacher possible. Micro-teaching renders realistic predictions of how visual, audio and student interactions are (Orlich et al., 1990). In general, it is possible for a candidate teacher to observe a range of micro-teaching experiences in order to have proficiency in instructional styles, strategies and skills, but with video camera recordings. Such repetitive teaching, feedback and repetition phases help the teacher achieve one's teaching abilities. The aim of this study is to investigate the effect of technology assisted micro teaching practices on the perception of technology use teachers. In response to this objective, the following questions were sought:

1. What are the contributions of the technology-supported courses?
2. What are the opinions of the candidates for evaluating the applications that they have realized in the special teaching methods course by the other candidates?
3. What are the specific teaching methods of the prospective teachers and their opinions on the micro-teaching method applied in this course?

Method

This section includes; the study group, the data collection tools, and analyzes of the data.

The Desire of your Research

The research is structured with a qualitative approach. In this study descriptive analysis was used from qualitative research types.

Working Group

The results of this research were carried out with 45 students (25 female-20 male) who were educated in the special education methods course of the fall semester of 2017-2018 in Gaziantep University Nizip Education Faculty Department of Social Studies.

Data Collection Tools

The data of the study were obtained by asking three open-ended semi-structured.

Analysis of Data

In this study, collected data were analyzed using descriptive analysis technique from analysis techniques in qualitative research methods. The purpose of descriptive analysis is to introduce a format in which raw data can be read and used by readers. The data obtained in the descriptive analysis are summarized and interpreted according to the previously determined theme. In this analysis, direct citation is often given in order to reflect the views of the individuals seen or observed in a striking way (Yıldırım & Şimşek, 2005).

Findings and Comments

Findings and Interpretations for the First Subproblem;

What are the contributions of the technology-supported courses to you? In spite of these questions, most of the prospective teachers have stated that they have done the appropriate use of the intelligent board for their purpose and that they have acquired knowledge and skills about effective use of technology after these applications. However, female teachers said that they are less influenced by technological knowledge and skills than male teacher candidates.

Findings and Interpretations for the Second Subproblem

What are the opinions of the candidate candidates to evaluate the applications that they have realized in the course of special teaching methods by other candidates? When asked about the answers given by teacher candidates to the evaluation form, it is seen that all the teacher candidates, except for the eight teachers, have generally positive views towards the teaching they have realized. Eight of them described the micro-teaching they performed as "bad," in general.

Findings and Interpretations for the Third Subproblem

What are the specific teaching methods of teacher candidates and their opinions on the micro teaching method applied in this course? In this study, 45 of the 45 teachers who participated in the study stated that the lessons they had taken from the candidates were taken to the videos and they were able to see their missing and positive aspects. Of the 45 teacher candidates, 29 indicated that the implementation had a positive effect on their development. Some of them have stated that they allow them to throw away the "nuances" of the practice.

Results and Suggestions

This study has been carried out with 45 social studies teacher candidates. It has been observed that social science teacher candidates have a positive effect on the technology self-sufficiency of technology-assisted micro-education practices in the detected findings. It was determined that the teacher candidates who participated in the micro-teaching practice were satisfied with this application and that the application had a positive effect on the development of the teacher candidates. Nevertheless, teacher candidates in such courses have not been able to provide a true classroom education, and some teacher candidates have stated that they are adversely affecting their teaching. For this reason, it is thought that the use of micro-teaching method will be effective in teaching practice courses. Most teacher candidates stated that they were excited during the application. Detecting the causes of this excitement is thought to be effective in developing excitement reduction methods. For example, in this study, it was determined that some teacher candidates were experiencing an excitement caused by their anxiety about not being able to adjust the course time.

Acknowledgements

This work was presented at the International Conference on Education in Mathematics, Science and Technology (ICEMST).

References

Aydın, İ. (2016). Öğretimde denetim. *Pegem Atıf İndeksi*, *2016*(6), 1-280.

Çakır, R., & Yıldırım, S. (2009). What Do Computer Teachers Think About The Factors Affecting Technology Integration In Schools. *İlköğretim Online*, 8(3), 952-964.

Hacat, S. O. (2018a). Assessment of the Basic Law Lesson Consistent with the Opinions of Social Studies Pre-Service Teachers. *International Journal of Higher Education*, *7*(1), 103-110.

Hacat, S. O. (2018b). Opinions of Middle School Students on the Justice Concept within the Framework of Social Studies Education. *International Journal of Higher Education*, *7*(2), 210.

Higgins, A. and Nicholl, H. (2003). The Experiences of Lecturers and Student in the Use of Microteaching as a Teaching Strategy. *Nurse Education in Pratice*. 3, 220-223.

Jang, S. J.,&Tsai, M. F. (2012). Exploring the TPACK of Taiwanese Elementary Mathematics and Science Teachers With Respect to Use of Interactive Whiteboards. *Computers & Education*, 59(2), 327-338.

Joshi, S. M. (1996). Effectiveness of Microteaching as Technique in Teacher Preparation Programme University of Baroda.

Kalın, Ö. U. (2017b). Analysis of 7 th Grade Social Studies Course Book According to Different Readability Formulas. *International Online Journal of Educational Sciences*, *9*(4).

Karaman, P., & Şahin, Ç. (2017). Öğretmen Adaylarının Ölçme-Değerlendirme Okuryazarlıklarının Mikro-Öğretim Yoluyla Geliştirilmesi. *Electronic Turkish Studies*, *12*(4).

Kennewell, S., & Morgan, A. (2003). Student Teachers' Experiences and Attitudes Towards Using Interactive Whiteboards in The Teaching and Learning of Young Children. In Proceedings of The International Federation For Information Processing Working Group 3.5 *Open Conference on Young Children and Learning Technologies*-Volume 34 (pp. 65-69). Australian ComputerSociety, Inc.

Koçoğlu, E. (2013). Sosyal Bilgiler Öğretmen Adaylarının, Okul Yöneticilerinde Olması Gereken Demokratik Tutum Ve Davranışlara İlişkin Algıları &60; Br&62; Social Studies Teacher Candidates Perceptions Of School Principals Should Not Have Democratic Attitudes And Behaviours. *Turkish Studies*, *8*(6), 413-430.

Koçoğlu, E. (2014). Sosyal bilgiler öğretmenlerinin sosyal bilgiler kavramına ilişkin imgesel algıları. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *15*(3).

Koçoğlu, E. (2015). Social Studies Teachers' Perspective of Religion Education in Turkey. *International Online Journal of Educational Sciences*, *7*(1).

Kpanja, E. (2001). A Study of The Effects of Video Tape Recording in Microteaching Training. *British Journal of Educational Technology*. 32, 483-486.

Mccury, D. S. (2000). Technology for Critical Pedagogy: Beyond Self- Reflection With Video. *Society for Informational Technology & Teacher Educationa Conference*, 8-12 February 2000, Proceedings, Vol: 1-3 pp. 20-112.

Olivero, J. L. (1980). Microteaching: Medium for Improving Instruction. *Charles Merill and Co*.Orlich, D. C., Harder, J. R., Callahan, C. C., Kauchak, D. P., Pendergrass, R. A., Keogh, A. J. and Gibson, H. (1990). *Teaching Strategies. (Third Edition).* Canada: Heat and Company.

Sancar Tokmak, H., Incikabi, L., & Yanpar Yelken, T. (2012). Differences in The Educational Software Evaluation Process for Experts and Novice Students. *Australasian Journal of Educational Technology,* 28(8), 1283-1297.

Seferoğlu, S. S., & Akbıyık, C. (2005). İlköğretim Öğretmenlerinin Bilgisayara Yönelik ÖzYeterlik Algıları Üzerine Bir Çalışma. *Eğitim Araştırmaları Dergisi*, 19, 89-101.

Seferoğlu, S. S., Akbıyık, C., & Bulut, M. (2008) İlköğretim Öğretmenlerinin ve Öğretmen Adaylarının Bilgisayarların Öğrenme/Öğretme Sürecinde Kullanımı ile İlgili Görüşleri. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*,35:273-283.

Tekelioğlu, S., Sürücü, M., Uğur, B. S., Dönmez, A., Ok, M., & Eren, F.(2010). S*mart Board(Akıllı Tahta)'un Eğitime Entegrasyonu Sunum Raporu.*

Ulu Kalin, Ö. (2017a). Creating Interactive Student Workbook for Primary Education Social Studies Class and Researching Its Efficiency. *Journal of Education and Practice*, *8*(12), 33-40.

Usta, E., & Korkmaz, Ö. (2010). Pre-service Teachers' Computer Competencies, Perception of Technology Use And Attitudes Toward Teaching Career. *International Journal of Human Sciences*, 7(1), 1335-1349.

Warwick, P.,&Kershner, R. (2008). Primary Teachers' Understanding of The Interactive Whiteboard As A Tool for Children's Collaborative Learning and Knowledge- Building. *Learning, Media and Technology*, 33(4), 269-287.

Yıldırım, A. ve Şimşek, H. (2005) Sosyal Bilimlerde Nitel Araştırma Yöntemleri. (2. baskı). Ankara: *Seçkin yayıncılık*.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 303-315

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Lebanese Public Schools Principals' Attitudes, Level of ICT Use and Leadership Style

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Abstract: The purpose of this study was to investigate attitudes towards ICT, level of ICT use, and leadership style of the Lebanese public schools" attending a training program at the Lebanese University, Faculty of Education. The training program, in which 204 principals from all over Lebanon participated, lasted for three months. At the end of the program, they filled a survey questionnaire and only 192 filled-in the questionnaire. Data collected were analyzed using descriptive analysis and correlations were calculated to identify the relationships between ICT use and gender, age, number of computers at school, earned Diploma, geographical location. School principals agreed that they benefit greatly from the ICT course; it helped them in improving their computer skills relevant to their administrative work. Findings also suggest that there is a no significant correlation between the use of ICT and school principal gender and age, the good equipment of schools is irrelevant with the school geographical location (urban/rural city). Moreover, within this study, the researchers identify significant challenges faced by the trainees" school principals, for instance, the little number and the lack of computers in their schools, the absence of IT teachers and even many of them did not use often computers in their daily routine works before the training program. Finally, Lebanese school principals adopted an administrative style with an emphasis on the accountable management behavior. Future qualitative studies are recommended to gain in-depth knowledge about the use of ICT by school principals in their schools.

Keywords: School principals" attitudes, University training program, ICT

Introduction

Literature about leadership and ICT confirmed the importance of ICT integration in the school system that elevates the quality of education and the pedagogical use of technology in schools. This literature highlighted the vital role of the school leader in delivering and supporting ICT in schools. In addition, ICT is linked closely to the quality of living, globalization, and multiculturalism. Because we are living in an increasing demanding and dependent society on technology and this requires an emerging school system based on ICT.

Literature has shown that ICT integration in schools is linked to the readiness of school principals to adopt and to facilitate the implementation of ICT in their schools. It is evident that ICT literacy or Digital literacy or the preparation for the 21st Century skills, like utilization of ICT in their daily life can be successfully implemented when school leaders (Afshari et al, 2012; Oluyemisi, 2015; Polizzi, 2011) and teachers (Albirini, 2006; Sangrà, and González-Sanmamed, 2010; Teo 2006) adopt a positive attitude towards the utilization and integration of ICT in instruction.

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Dawson and Rakes (2003) found that the age of the principal is a critical factor affecting technology integration in schools, with older principals (ages 41 to 55 years) influencing technology integration more than younger principals. They also found that the number of years that the principal has been in his/her administrative position does not influence ICT integration. Furthermore, Anderson and Dexter (2005) believed that "technology leadership has greater leverage on desired outcomes than does technology infrastructure and expenditures" (p. 73).

Rusmini (2012; Mwalongo, 2011) advocated that school leaders need to develop ICT skills in order to be effective in their new role as a technology usage leader.

An example of Arab Countries, Bahrain, Abdul Razzak (2013) reported that the status and conditions of the implementation of ICT in Bahraini public schools is poor; she found that the schools are in need of technology plans that focus, in addition to individuals and their attitudes towards ICT integration, to also promote a school culture, which encourages exploration of new teaching, learning, and management techniques. The school leaders, however, need training on the important role they can play in leading and managing ICT integration in schools, since they are expected to positively influence everyone and everything else in the direction of more and better technology integration.

In Cyprus, Papaioannou and Charalambous (2011) explored the Cyprus primary school principals‟ attitudes towards Information and Communication Technologies (ICT) as well as their perceptions about the factors that facilitate or inhibit ICT integration in primary schools in Cyprus. They found that principals hold, in general, positive attitudes towards ICT, but significant differences were observed across gender, years of service, academic qualifications, access to a computer and the internet at home, in-service training on ICT for teaching and learning purposes, existence of a computer in the principal‟s office, computer experience, and the principals‟ attitudes towards ICT. In addition, even though principals value the importance of ICT in the teaching and learning process as well as for the fulfilment of their managerial and administrative purposes, they still need more tailor-made in-service training and incentives in order to transfer their theoretical enthusiasm into practice. This study concluded that ICT integration in primary schools in Cyprus can be facilitated by principals regardless of their access to technology resources and the technical assistance that is provided by Ministry of Education and Culture (MOEC).

In Lebanon, Ghamrawi (2013) investigated the relationship between the leadership styles exhibited by 651 Lebanese public school principals and their attitudes and the level of use of technology for educational purposes in their schools. Moreover, one teacher from each participant public school (N = 651) completed a questionnaire pertaining to the level of use of technology in the school. The study has shown that though the principals of these schools bear positive attitudes towards computers; they did not consider them as important tools for the enhancement of teaching and learning. They valued computers as tools for the facilitation of the management of information in their schools and for administrative purposes. The study also revealed the existence of positive correlation between the autocratic leadership style of school principals and their negative attitudes towards the use of ICT for educational purposes. In addition, the results of the study accentuate another positive correlation existing between principals‟ attitudes towards the use of ICT for educational purposes and the level of its use by their teachers in schools.

An OECD report, *Improving School Leadership*, summarizes the changing landscape of schools and their management over recent decades (Pont, Nusche and Moorman, 2008); it argues that to meet the educational needs of the 21st century the principals in primary and secondary schools must play a more dynamic role and become far more than an administrator of top-down rules and regulations. Schools and their governing structures must let school leaders lead in a systematic fashion and focus on the instructional and learning processes and outcomes of their schools. The same OECD report, recommends that effective school management comes from engagement in instructional leadership. At the same time, effective leadership also involves administrative accountability and a workable bureaucracy (Pont, Nusche and Moorman, 2008). OECD (2009) report classified school leader‟s management into instructional leadership and administrative leadership styles (Figure 1).

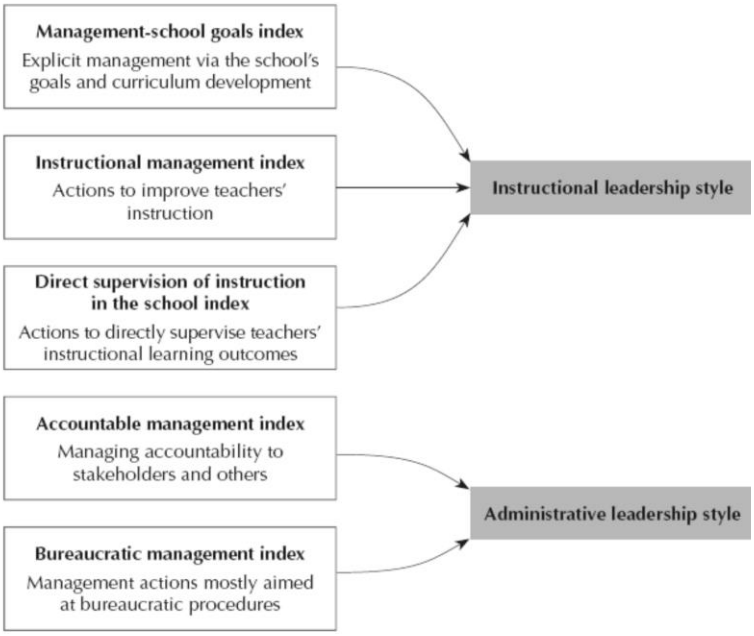

Figure 1. Composition of the indices for instructional and administrative leadership (from OECD, TALIS Database, 2009)

The purpose of the current study is to investigate the principals‟ attitudes, level of ICT and their leadership style. The lack of research on the use of ICT by Lebanese school principals, as well as the assessing of training programs at the Faculty of Education with respect to ICT and leadership for school principals would be a valuable addition to the literature. In Lebanon, there are few research studies concerning the integration of technology within the school setting, especially in the administrative purpose and its impact on the work of the school itself.

Research Questions

The research is experimental and tries to answer the following questions:

1. What are Lebanese school principals‟ attitudes toward the use of ICT in their schools, at the end of the training program at the Faculty of Education?
2. What is the level of ICT use by these school principals?
3. How did school principals benefit from the training course at the Faculty of Education, in terms of ICT?
4. What are Lebanese school principals‟ leadership styles at the end of the training program?

Method

The training program for the Lebanese public schools principals was 3 months in duration. The 204 principals came to the Faculty 2 days per week. The program was an intensive one that covered 6 courses: Educational Leadership (36 hrs), Educational Supervision (18 hrs), Educational Management and Planning (18 hrs), Approaches to Active Learning (18 hrs), Employees Legislations (18 hrs) and Technology and Administration (36 hrs).

For the independent variables: Age, gender, principal diploma, number of computers at school and school location.

For the dependent variables: School principals‟ attitudes towards ICT, school principals‟ computer literacy and use of ICT, leadership style.

Sample

The original sample of the school principals was 204. At the training program at the Faculty of Education, they were administered a questionnaire on leadership style and their attitude toward ICT. The number of principals who filled-in the questionnaire was 192. The number of principals of age ≥ 59 was 66 and 126 principals with age ≤ 59. They were disseminated from all over Lebanon. Their ages ranged between 33 and 64 years old (Figure 2). Finally, 92 or 47.59% Males and 100 Females (52.41%) (Figure 3).

Participants were: Forty seven (24.5%) from the North and Akkar, 18 (9.5%) from Beirut, 29 (15%) from Bekaa, 68 (35.5%) from Mount Lebanon, and 30 (15.5%) from The South and Nabatiyeh. The majority of school principals were graduates from the Lebanese University. Their diplomas cover various levels from PhD to Master, Maitirse and Licence. Their diplomas also cover a wide spectrum of specializations: from Languages, Science and Mathematics, Politics to Mechanics. Schools were also various; KG, primary, intermediate and high school as well as vocational technical institute. Their administrative experience range from one to 33 years, as for their teaching experience, it ranges from three to 40 years.

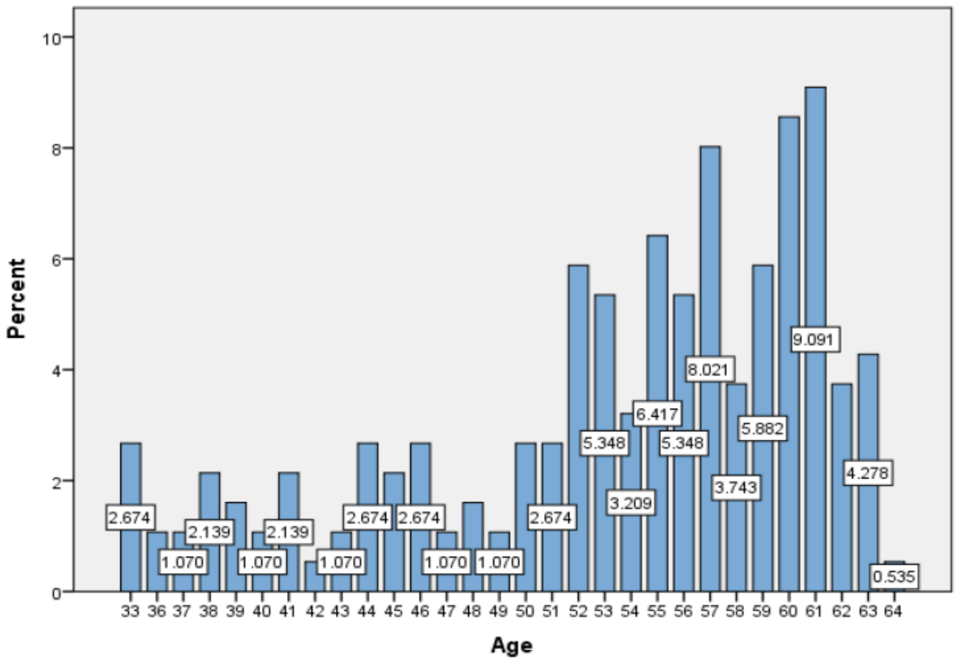

Figure 2. The age sample distribution

Figue 3. The age sample distribution by age and gender

Instrument

A questionnaire was used to collect both quantitative and qualitative data. It consisted of 120 items, 30 of them were open-ended questions. The questionnaire aimed at collecting school principals" opinion on ICT as well as their attitude towards ICT and the training course. The questionnaire consisted of 6 sections: 1. Personal and professional profiles, 2. Computer Skills, 3. Problems of infrastructure, 4. Computer Literacy before and after the ICT Course, 5. Leadership style, 6. Principals" attitudes towards ICT use.

The questionnaire was inspired mainly from Albirini (2006) questionnaire on attitudes towards ICT, the TALIS questionnaire, the Teaching and Learning International Survey (2009), is a project of the Organization for Economic Cooperation and Development (OECD) and the PITLICTQ questionnaire (Leng, 2008), designed to investigate teachers' perceptions of Positive Influence of Transformational Leadership Practices on the Integration of ICT into teaching.

Data Analysis

At the end of the training program, school principals received a survey questionnaire, and the data collected were processed by using Statistical Package for Social Science (SPSS, 21) program. It was used to analyze data as follows:

1. Descriptive analysis (Frequency and Percentages).
2. Pearson's correlation coefficients were used to identify the relationships between ICT use and gender, age, number of computers at school, earned Diploma, geographical location or province.

Results and Discussion

Research Question 1: What are Lebanese school principals" attitudes toward the use of ICT in their schools?
Principals" responses to the 15 questions from section VI (Leadership and attitude towards computers) of the questionnaire, related to attitudes, revealed that overall, school principals have a positive attitude towards the use of computers for educational purposes; 94.3% believed that computers save time and effort and they can help them in organizing their work, while 84.9% disagree that it is better to do things by hand rather than with a computer. Public school principals believed that computers are important in teaching and learning: 77.1% believed that teaching with computers offer real advantages, 73.8% thought that computers will improve education and that computers are a fast means to get information (93.8%) (Table 1).

Table 1. School principals" attitudes towards ICT at the end of the program

Items	Agree %	Disagree %	No opinion %
Computers would help me organize my work	94.3	3.1	2.6
Using computers would make subject matter more interesting	80.7	9.4	9.9
Computers save time and effort	94.3	1.6	4.1
Using computers is enjoyable	88.5	2.6	8.9
Computers make me much productive	83.9	8.9	7.2
Computers have proved to be effective learning tools	86.5	4.2	9.3
Computers can enhance students" learning	88.5	3.6	7.9
Teaching with computers do not offer real advantages	8.9	77.1	14
I believe that using computers in teaching is useful	91.7	1.0	7.3
Computers are a fast means of getting information	93.8	0.5	6.15
I would like to learn more about computers	91.7	1	7.3
Computers will not necessarily improve education	12.5	73.8	13.7
Computers do not scare me at all	79.2	10.9	9.9
I would rather do things by hand than with a computer	8.3	84.9	6.8
I do not like talking with others about computers	9.9	66.7	23.4

Research Question 2: What is the level of ICT use by these school principals?
Section IV of the questionnaire highlights principals" responses to their computer skills literacy and development during the training program at the faculty of Education.
Before the ICT Course

Table 2 displays data related to principals‟ computer literacy; 39.1% of the public school principals admitted that they performed poorly with the Internet, 45.3% used poorly the Excel and Word, while only 3.1% have an advanced performance of ActivInspire.

Table 2. School principals‟ computer literacy at the beginning of the program

Category	Performance			
	Advanced	Beginning	Poor	No answer
Word	61 (31.8%)	67 (34.9%)	63 (32.8%)	1 (0.5%)
Excel	37 (19.3%)	66 (34.4%)	87 (45.3%)	2 (1%)
PowerPoint	28 (14.6%)	57 (29.7%)	104 (54.2%)	3 (1.6%)
ActivInspire	6 (3.1%)	47 (24.5%)	130 (67.7%)	9 (4.7%)
Internet (E-mail, …)	48 (25%)	64 (33.3%)	75 (39.1%)	5 (2.6%)

After the ICT Course

At the end of the training course, 65.6% believed that they have an advanced performance in Word, Excel (52.1%) and ActivInspire (13%). The use of the Internet increased by 43.8% while only 25% used Internet before the training course (Table 3).

Table 3. School principals‟ computer literacy at the end of the program

Category	Performance			
	Advanced	Beginning	Poor	No answer
Word	126 (65.6%)	57 (29.7%)	8 (4.2%)	1 (0.5%)
Excel	100 (52.1%)	79 (41.1%)	11 (5.7%)	2 (1%)
PowerPoint	98 (51%0	81 (42.2%)	10 (5.2%)	3 (1.6%)
ActivInspire	25 (13%)	109 (56.8%)	40 (20.8%)	18 (9.4%)
Internet (E-mail, …)	84 (43.8%)	70 (36.5%)	24 (12.5%)	14 (7.3%)

In sum, school principals‟ computer literacy improved after the training course: only 25 % of principals believed that they have an advanced level of use the internet and mails.., this number increases to 43.8% after three months of the training program. In addition, 3.8% of the sample has an excellent command of the word processing, it increased to 65.6%. Moreover, 42.2% believed that they performed poorly the use of Power Point Software; it turns up to 51% after the training at the Faculty. Finally, 67.7 % have a poor level in Activinspire use, at the end of the training program, it increases to 13%.

Pearson's correlation coefficients were used to find whether there are relationships between: ICT use and Age, ICT use and Gender, ICT Use and PC Number at school ICT Use and Earned Diploma and ICT Use and school geographical Location.

No significant relationship (Pearson's R =.094; Spearman Correlation=.083) was found between the the use of ICT and age, no relation (Pearson's R = -.089; Spearman Correlation= - .089) was found between ICT use and Gender, ICT Use and PC Number at school ICT use (Pearson's R =-.047; Spearman Correlation=.052) and Earned Diploma and ICT use (Pearson's R =-.173; Spearman Correlation=-.188) and school geographical Location (Pearson's R = .032; Spearman Correlation=.032) (Table 4).

Table 4. The correlations between the different independent variables

Correlation of Gender and ICT Use

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	-.089	.086	-1.036	.302[c]
Ordinal by Ordinal	Spearman Correlation	-.089	.086	-1.036	.302[c]
N of Valid Cases		135			

Correlation of Age and ICT Use

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.094	.084	1.093	.276[c]
Ordinal by Ordinal	Spearman Correlation	.083	.085	.968	.335[c]
N of Valid Cases		137			

Correlation of ICT Use and Number of Computers at School

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	-.047	.073	-.549	.584[c]
Ordinal by Ordinal	Spearman Correlation	.052	.086	.604	.547[c]
N of Valid Cases		139			

Correlation between ICT Use and Earned Diploma

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	-.173	.082	-1.866	.065[c]
Ordinal by Ordinal	Spearman Correlation	-.188	.089	-2.030	.045[c]
N of Valid Cases		115			

Correlation between ICT Use and Geographical Location

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.032	.088	.369	.713[c]
Ordinal by Ordinal	Spearman Correlation	.023	.088	.268	.789[c]
N of Valid Cases		133			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Related to ICT use with Age and Gender

Table 5 revealed that, compared to 10.3% of the sample aged 60 years old and above, 63% of the sample aged 59 and below tend to use ICT in their work. Younger female school principals use more ICT (20.3%) compared to male principals (12.5%) of the same age group. Finally, 8.8% older male principals do not use ICT in their daily work.

Table 5. Use of ICT by school principals distributed by age and gender

Age	Use of ICT	Male	Female	Total
≤ 59	Yes	24 (12.5%)	39 (20.3%)	63 (32.8%)
	No	14 (7.3%)	21 (10.9%)	35 (18.2%)
	unanswered	12 (6.2%)	16 (8.3%)	28 (14.5%)
≥ 60	Yes	13 (4.6%)	11 (5.7%)	24 (10.3%)
	No	17 (8.8%)	6 (3.1%)	23 (11.9%)
	unanswered	12 (6.2%)	7 (3.6%)	19 (9.8%)

Overall, there was no correlation between the use of ICT and the school location, age, gender, number of computers at school and school principal diploma.

Research Question 3: How did school principals benefit from the training course at the Faculty of Education, in terms of ICT? To the open question: how ICT can help you in your work? Principals emphasized on the use of ICT in their daily routine, such as communication (18.7%) and administrative work (37.9%). For instance, 21.8% admitted that it helps with their work, communicating with the ministry (5.7%) and it makes their work easier (21.8%). Finally, 2% of the sample mentioned student evaluation (Table 6).

Table 6. School principals‟ answers to „How ICT can help you in your work‟

School principals‟ responses	Number of answers
It helps as a reference	43 (22.4%)
It makes work easier	42 (21.8%)
It makes communication easier	24 (12.5%)
It helps document typing	20 (10.4%)
It saves time	17 (8.8%)
It helps sending reports to ministry etc..	11 (5.7%)
It helps improving administration work	11 (5.7%)
I gained more self-esteem	6 (3.1%)
It helps learn new things	5 (2.6%)
It helps students evaluation	4 (2%)
It helps with Activinspire	3 (1.5%)
I can work with no need to IT instructor	3 (1.5%)
It helps with distance learning	1 (0.5%)

To the open question, do you use ICT by yourself? Only 182 principals answered. Table 7 highlights their answers, where 38% agree; among them 23.4% female principals appreciate more than male principals (14.5%) the use of ICT in their daily work (Table 7).

Table 7. School principals‟ use of ICT at work

	Male	Female	Total
Yes	28 (14.5%	45 (23.4%)	73 (38%)
No	33 (17.1%)	27 (14%)	60 (31%)
No answer	23 (12%)	26 (13.5%)	49 (25.5%)

Overall, school principals agreed that they benefit greatly from the ICT course; it helped them in improving their computer skills relevant to their administrative work. This showed that these principals had a lack in these skills and the training course was a good opportunity for them to enrich their ICT skills: they wrote that they can use ICT for various tasks, such as, communication with the ministry, student evaluation and distance learning. Finally, they gained self-esteem.

Research Question 4: What is Lebanese school principals‟ leadership style at the end of the training program?
To answer this question, section V of the questionnaire consisted of 26 closed items. Originally, the items were first categorized and analyzed according to: Leadership and School Environment (8 items), Leadership and Students (4 items) and Leadership and school teachers (14 items). The principals could also add to each part their comments (Table 8).

In Table 8, principals‟ answers were first categorized into: Leadership and School Environment (6 items), Leadership and Students (3 items) and Leadership and school teachers (11 items). The principals could also add to each part their comments.

To analyze data related to the two types of leadership and management styles (instructional and administrative), the 20 items from OECD (2009) study were also used and tabulated (Table 9).

As appeared in Table 8, 89.1% considered as an important part of the school principal is to present new ideas to the parents in a convincing way, 71.4% that it is their task to pay attention to disruptive students, 80.1% believed that the main part of their job is to ensure that the teaching skills of the staff are always improving. Only, 12% take the initiative to discuss matters, when a teacher has problems in his/her classroom. School principals main role is to deal with parents (89.1%). For students, only when there is student misbehaviour (71.4%). Principals are not involved in the policy of the curriculum development; only 3.1% use student performance results to develop the school‟s educational goals.

Table 8. School principals‟ answers to leadership-school environment-student-teacher

Item No		Often %	Sometimes %	Never %	No answer %
	Leadership and School Environment				
1	I stimulate a task-oriented atmosphere in my school	17.7	6.8	1	74.5
2	I communicate school vision to staff and students	76.6	19.3	1	3.1
3	I give high priority to developing within the school a shared set of values, beliefs and attitudes related to education	54.2	42.7	1	2.1
4	An important part of my job is to create an orderly atmosphere in the school	2.6	70.8	26.6	0
5	An important part of my job is to present new ideas to the parents in a convincing way	89.1	8.9	0.5	0.7
6	An important part of my job is to ensure ministry approved instructional approaches are explained to new teachers, and the more experienced teachers are using these approaches	50	43.8	2.1	4.1
	Leadership and Students				
7	I use student performance results to develop the school‟s educational goals	3.1	31.8	60.4	4.7
8	I monitor students‟ work	2.6	2.1	0.5	94.8
9	I pay attention to disruptive behaviour in classrooms	71.4	24.5	1	3.1
	Leadership and school teachers				
10	I facilitate opportunities for staff to learn from each other	56.8	33.9	4.7	4.6
11	When a teacher brings up a classroom problem, we solve the problem together	86.5	9.9	1	2.6
12	I take rarely teachers‟ opinions into account when making decisions	63	32.3	0.5	4.2
13	I have high expectations of teachers as professionals	55.2	39.1	2.6	3.1
14	I provide resources to support teachers‟ professional growth	70.3	24	1.6	4.1
15	When a teacher has problems in his/her classroom, I take the initiative to discuss matters	12	29.7	53.1	5.2
16	It is important for the school that I see everyone sticks to the rules	39.6	53.6	3.1	3.7
17	I inform teachers about possibilities for updating their knowledge and skills	63.4	31.9	2.1	2.6
18	I give teachers suggestions as to how they can improve their teaching	78.5	16.2	1.6	3.7
19	A main part of my job is to ensure that the teaching skills of the staff are always improving	80.1	14.7	1	4.2
20	I observe instructions in classrooms	55.5	41.4	0.5	2.6

In Table 9, the 20 items encompassing the two leadership styles (administrative and instructional) were also classified into the 5 five indices of management behavior: the management-school goals index (2 items),the instructional management index (7 items), the direct supervision of instruction in the school index (3 items), the accountable management index (3 items) and the bureaucratic management index (5 items).

According to (OECD, 2009), principals scoring high for the management style appeared to be of instructional leadership style. This index was derived by averaging the indices for the first three management behaviors, management for school goals, instructional management and direct supervision of instruction in the school (Table 9).

Table 9. School principals‟ answers to the leadership and management styles

	Indices	Item no	Description of the item	Often %	Sometimes %	Never %	No answer %
Instructional Leadership	Management-school goals index	2	I communicate school vision to staff and students	76.6	19.3	1	3.1
		7	I use student performance results to develop the school‟s educational goals	3.1	31.8	60.4	4.7
	Instructional management index	9	I pay attention to disruptive behaviour in classrooms	71.4	24.5	1	3.1
		10	I facilitate opportunities for staff to learn from each other	56.8	33.9	4.7	4.6
		11	When a teacher brings up a classroom problem, we solve the problem together	86.5	9.9	1	2.6
		13	I have high expectations of teachers as professionals	55.2	39.1	2.6	3.1
		14	I provide resources to support teachers‟ professional growth	70.3	24	1.6	4.1
		15	When a teacher has problems in his/her classroom, I take the initiative to discuss matters	12	29.7	53.1	5.2
		17	I inform teachers about possibilities for updating their knowledge and skills	63.4	31.9	2.1	2.6
	Direct supervision of instruction in the school index	8	I monitor students‟ work	2.6	2.1	0.5	94.8
		18	I give teachers suggestions as to how they can improve their teaching	78.5	16.2	1.6	3.7
		20	I observe instructions in classrooms	55.5	41.4	0.5	2.6
Administrative Leadership	Accountable management index	3	I give high priority to developing within the school a shared set of values, beliefs and attitudes related to education	54.2	42.7	1	2.1
		5	An important part of my job is to present new ideas to the parents in a convincing way	89.1	8.9	0.5	0.7
		6	An important part of my job is to ensure ministry approved instructional approaches are explained to new teachers, and the more experienced teachers are using these approaches	50	43.8	2.1	4.1
		19	A main part of my job is to ensure that the teaching skills of the staff are always improving	80.1	14.7	1	4.2
	Bureaucratic management index	1	I stimulate a task-oriented atmosphere in my school	17.7	6.8	1	74.5
		4	An important part of my job is to	2.6	70.8	26.6	0

	create an orderly atmosphere in the school				
12	I take rarely teachers‟ opinions into account when making decisions	63	32.3	0.5	4.2
16	It is important for the school that I see everyone sticks to the rules	39.6	53.6	3.1	3.7

To simplify the reading of Table 9, Table 10 displays the average numbers of the five leadership management behaviors according to the instructional and administrative leadership styles. Equal 65.3% of the school principals have a management school goals and a direct supervision of instruction in the school, compared to 86.9% who present an instructional management. On the other hand, Lebanese principals display a strong administrative style: 95.8% for the accountable management index and 71.5% for the bureaucratic management index.

Table 10. School principals‟ answers to the leadership style

	Indices	Often %	Sometimes %	Never %	No answer %
Instructional Leadership	Management-school goals index	39.8	25.5	30.7	3.9
	Instructional management index	59.3	27.6	9.4	3.6
	Direct supervision of instruction in the school index	45.5	19.9	0.8	33.7
Administrative Leadership	Accountable management index	68.3	27.5	1.1	2.7
	Bureaucratic management index	30.7	40.8	7.8	20.6

The administrative leadership style is derived by averaging the indices for the accountable management behavior and bureaucratic management behavior. This style of management focuses on administrative tasks, enforcing rules and procedures, and accountability (Table 11). For instance, the administrative index 83.6% was calculated by adding the averages of the 2 indices (accountable and bureaucratic) for the scales often and sometimes.

Table 11. School principals‟ average answers to the leadership style

Indices	Present %	Not present %	No answer %
Instructional Leadership	72.5	13.6	13.7
Administrative Leadership	83.6	4.6	11.6

In sum, Lebanese principals adopt an administrative Leadership (83.6%) with emphasis on the accountable management style (68.3%) (Table 11).

Conclusion

This study tackled the school principals‟ ICT level, their leadership styles, their use and attitudes towards ICT at the end of the training program at the Faculty of Education, Lebanese University.
It has shown that:

1. There was no significant correlation between the use of ICT and the school principal earned degree, the school location, age, gender, number of computers at school. This is good because it might be, because that school needs in ICT equipment, is related to the school leader himself/herself and how much he/she can have strong ties with the local community and the ministry.
2. School principals have a positive attitude towards the use of computers in teaching and learning similar to Ottestad (2013).
3. School principals assured that they benefit greatly from the ICT course; their administrative work improved (e.g., communication with the ministry, student evaluation and distance learning…) because their ICT skills improved. Above all, they gained self-esteem.
4. Lebanese school principals adopted an administrative style with an emphasis on the accountable management and less the instructional management. This means that their role is to ensure that ministry-approved instructional approaches are explained to new teachers and that all teachers are held accountable for improving their teaching skills. These principals also focus on convincing students‟ parents of the need for new ideas and procedures at the school (OECD, 2009).

From all the above, this study is conform to previous research literature about leadership management and ICT that emphasized on the school principal role in facilitating the implementation and adoption of technology in their schools (e.g,, Laaria, 2013; Mingaine, 2013).

Recommendations

The authors could collect data only at the end of the training program. We could not know about their ICT profile, as well as the actual situation at their schools nor their leadership behaviors at the beginning of the training program, because of administrative difficulties.

Future field studies to gather qualitative data are encouraged to map Lebanese public schools regarding ICT equipment, in order to know the real situation and the school needs. It is known that most schools have photocopy machines and scanners for daily administrative work and less multimedia (LCD projector, video camera, overhead projector and laptop). But this multimedia is not enough for all classes. Moreover, it is a challenge for principals to make ICT infrastructure (labs with the computer desks, networks and e-learning materials) due to the high costs.

Finally, it is important for school principals to be part of ICT policy plans developed by the National Ministry of Education and Higher Education (MEHE).

Acknowledgements

The authors thank deeply the school principals involved in this study.

References

Abdul Razzak, N. (2013). Challenges facing school leadership in promoting ICT integration in instruction in the public schools of Bahrain. *Education and Information Technologies. The Official Journal of the IFIP Technical Committee on Education,* ISSN 1360-235, 18(4), DOI 10.1007/s10639-013-9283-7.

Afshari, M., Ghavifeker, S., Saedah, S., & Rahmad, S. (2012). Transformational Leadership Role of Principals in Implementing Informational and Communication Technologies in Schools. *Life Science Journal, 9*(1), 281-284.

Albirini, A. A. (2006). Teacher‟s attitudes toward information and communication technologies: the case of Syrian EFL teachers. *Journal of Computers and Education*, 47, 373-398.

Anderson, R. E., & Dexter, S. L. (2005). School technology leadership: An empirical investigation of prevalence and effect. *Educational Administration Quarterly*, *41*(1), 49-82.

Crow, G.M., Witherspoon Arnold, N., Reed, C.J., & Shoho, A.R. (2012). The Complexity of Leveraging University Program Change, *Journal of Research on Leadership Education* 7(2), 172–194.

Dawson, C., & Rakes, G. C. (2003). The influence of principals‟ technology training on the integration of technology into schools. *Journal of Research on Technology in Education*, *36*, 29–49.

Frye, B., O‟Neill, K., & Bottoms, G. (2006). *Schools can't wait: Accelerating the redesign of university principal preparation programs*. Atlanta, GA: Southern Regional Education Board.

Ghamrawi, N. (2013). The Relationship between the Leadership Styles of Lebanese Public School Principals and Their Attitudes towards ICT versus the Level of ICT Use by Their Teachers, *Open Journal of Leadership, 2*(1), 11-20, http://dx.doi.org/10.4236/ojl.2013.21002.

Jacobson, S.L., & Autumn, C. (2012). Important Shifts in Curriculum of Educational Leadership Preparation, *Journal of Research on Leadership Education* 7(2), 217–236.

Laaria, M. (2013). Challenges Encountered by Principals during Implementation of ICT in Public Secondary Schools, *Kenya, Journal of Sociological Research*, ISSN 1948-5468 2013, 4(2), pp. 1-19, www.macrothink.org/jsr.

Laaria, M. (2013). Leadership challenges in the implementation of ICT in public secondary schools, Kenya, *Journal of Education and Learning* 2 (1) 32-43 http://dx.doi.org/10.5539/jel.v2n1p32.

Leng, N.W. (2008). Transformational Leadership and the Integration of Information and Communications Technology into Teaching. *The Asia-Pacific Education Researcher,* 17:1, pp. 1-14.

Mwalongo, (2011). Teachers‟ Perceptions about ICT, Professional Development, Administration and Personal use. *International Journal of Education and Development using information and Communication Technology (IJEDICT), 7*(3), 36-49.

OECD (2009). Creating Effective Teaching and Learning Environments: First Results from TALIS – ISBN 978-92-64-05605-3, http://dx.doi.org/10.1787/608025205225.

Oluyemisi A. O. (2015). ICT and Effective School Management: Administrators‟ Perspective: Proceedings of the World Congress on Engineering 2015 Vol I, WCE 2015, July 1 - 3, 2015, London, U.K.

Ottestad, G. (2013). School Leadership for ICT and Teachers‟ Use of Digital Tools, *Nordic Journal of Digital Literacy,* , 8, NR 01-02, 107-125, www.idunn.no.

Papaioannou, P, & Charalambous, K. (2011). Principals‟ Attitudes towards ICT and Their Perceptions about the Factors That Facilitate or Inhibit ICT Integration in Primary Schools of Cyprus, *Journal of Information Technology Education,* 10, 349-369.

Polizzi, G. (2011). Measuring School Principals‟ Support for ICT Integration in Palermo, Italy, *Journal of Media Literacy Education,* 3:2, 113 – 122.

Pont, B., Nusche, D., & Moorman, H. (2008). Improving School Leadership. Volume 1: Policy and Practice, An OECD Publication, www.oecd.org/edu/schoolleadership.

Teo, T. (2006). Attitudes toward computers: A study of post-secondary students in Singapore. Interactive Learning Environment, 14(1), 17–24.

Rusmini, A. (2012). Managing The Use of ICT in Schools: Strategies for School Leaders, *Educational Administration and Management Journals,* Institute of Aminuddin Baki.

Sangrà, A., & González-Sanmamed, M. (2010) The role of information and communication technologies in improving teaching and learning processes in primary and secondary schools, *ALT-J, 18*(3), 207-220, DOI: 10.1080/09687769.2010.529108.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 316 - 322

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

The Analysis of Social Media Usage for Collaborative Learning

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Abstract: In today's world it is obvious that social media usage is getting involved into every aspect of our lives. Naturally, even collaborative learning processes, such as team creation, communication between team members, file sharing etc., are conducted via various social media channels. It is very crucial to understand that how these two concepts interact with each other and how different parameters affect them separately and together, as taking into consideration how these concepts play a big role in our daily lives. The purpose of this study is to discover the relationship between social media and collaborative learning in a deeper manner, specifying differences among categories like several age ranges, genders, and educational levels in this relationship and with the difference of past researches, to understand better the satisfaction level of people using these two concepts together. In order to understand better the relationship between social media and collaborative learning and the satisfaction level of using both of them; interactivity with peers, interactivity with teachers, engagement, perceived ease of use, perceived usefulness which affect social media usage and positive interdependence, individual accountability, active learning and group processing which affect collaborative learning are questioned in an online survey study. After examining and cleaning the collected data, most appropriate analyses are determined. Regression analysis shows that the change in the satisfaction level of the people who use social media for collaborative learning is related with perceived usefulness, individual accountability, active learning and age.

Keywords: Social media, Collaborative learning, Regression analysis

Introduction

Social media is getting widespread day by day among all people. In today's technological age, social media is getting an essential part of our lives and even in office or class. In this situation it is unthinkable that it does not have an effect on education as well. Naturally, rapid growth of the social media bring along certain effects on other related concepts such as collaborative learning. One of the base principles of collaborative learning is working in groups, therefore, for different complex grouping processes social media tools and using them is an easy and appealing way. A great deal of research has been conducted regarding the effect of social media on other related concepts. However, only a few of these studies have examined the effect of social media on collaborative learning and how people can satisfy from this interaction. In this study, in addition to specifying the satisfaction level of using social media for collaborative learning, it is also aimed to make explicit distinctness in this relationship regarding the demographic factors of students such as gender, educational level and age.

Literature Review

In today's world social media is inevitable part of our daily lives. Every single day, millions of people interact through social media and it creates a new online layer where people organize their lives. According to Tess (2013), defining social media is difficult because of the fact that it is in state of change. However, Edosomwan

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

et al. (2011) stated that social media is not a new concept; it has been changing since the dawn of human interaction. According to Dabbagh and Reo (2011) social media refers to networked tools or technologies that emphasize the social sides of the web like a medium of communication, collaboration, and inventive expression. In recent times, social media has impacted many aspects of human communication. There are technical, social, cultural, business related and even economic perspectives of social media usage. According to Van Dijck (2013), social media platforms changed the nature of private and public communication undoubtedly. Moreover, Van Dijck (2013) depicted that, the need for connectedness drove people to social media channels. With Web 2.0 users moved more of their everyday activities to online environments. Sometimes it can be seen that in the literature, the words of Web 2.0, User Generated Content and social media are used interchangeably. However, Kaplan and Haenlein (2010) specify the difference between these terms and they explain that social media can be considered as a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of User Generated Content.

Under such a penetration, it is unthinkable that such a prevalent thing is not related with learning activities. Tess (2013) stated that social media which has received recent attention could be an effective tool for educational purposes and the potential role for social media as a facilitator and enhancer of learning is worth to investigate. According to Liao et al. (2015), when students work together in groups or engage in collaborative activities, a channel for students opens up to argue and negotiate with each other and this ends up with a better learning experience through the collaborative exchange of views and feedback. As another point of view, Dillenbourg (1999) said that collaborative learning is the situation in which two or more people learn or attempt to learn something together. Via social media, a variety of actions such as connectivity, networking, instant messaging, information sharing etc. can be conducted and some of these actions are getting slightly more important when it comes to collaborative learning. Alkhathlan and Al-Daraiseh (2017) depicted that in social networking sites there are lots of opportunities for collaborative situations where several learning mechanisms can be implemented. Using these diverse features of social networking sites such as groups, discussion boards and messages can ensure the collaboration among peers which results their cognitive and self-explanation capabilities. Al-Rahmi and Othman (2013) pointed that social media is easing both teaching and learning, especially among students. Specifically on certain collaborative learning processes, like interactivity with peers, it is getting more crucial. The social media can be utilized for increasing researchers collaborative learning on group tasks, for instance it can be said that using social media makes it easy to reach other peers. Additionally, this case is not valid for only peers and students; the same case is valid for teachers, too. Gruzd et al. (2012) expresses that the purpose of social media in higher education includes enhancing communication and information sharing among both teachers and students. Wolf et al. (2012) stated that there is a demand for more effective collaborative learning through smooth communication between students and teachers. Therefore, social media channels can be counted for an alternative to communicate with others during collaborative learning processes.

In addition to all of these, it can be said that group processes in collaborative learning activities is getting easier with usage of social media rather than conventional ways. Al-Rahmi et al. (2015) clearly pointed that the collaborative learning experience in the social media environment is better than in a face-to-face learning and also social media could also benefit students by enabling them to enter new types of collaborative learning according to their interests.

In the light of all of these, it can be depicted that it is logical to approach social media and collaborative learning together. Therefore, the satisfaction level of using these two together is getting more significant.

Theoretical Framework and Research Model

To understand social media usage level and collaborative learning level constructs, the significant factors of both from educational point of view are derived from an elaborated literature review.

Social Media Usage

<u>Interactivity with Peers</u>**:** One of the opportunities that social media provides is interaction. According to Al-Rahmi et al. (2015) usage of social media facilitates to reach other peers. There are other gainings that social media provides like collaboration, relationship development among students, instantaneous opportunities for curricula dissemination and enhancement to the actual classroom (Fewkes and McCabe, 2012; Junco et al., 2011; Top, 2012).

Interactivity with Teachers: It is not always easy getting into interaction with teachers because of the some reasons like formality or limited office hours. According to Gruzd et al. (2011) social media expands this potential and offers some space for informal conversations and also strengthens existing associations. Additionally, Frye et al. (2010) and Liu et al. (2011) asserted that lecturers and supervisors using social media should be able to play an active role in collaboration with students because it is their responsibility to promote student's creativity, assess activities, and explain misunderstanding arising from the content area and knowledge creation in order to sustain the learning environment integrity. Maloney (2007) pointed that some also have welcomed the capability of social media services to provide teachers a forum for simple media and positive networking with students.

Engagement: According to Chretien et al. (2009) student's engagement signifies both time and effort and they indicate that peers are extremely influential to student learning.

Perceived Ease of Use: Perceived simplicity of use is related to the individual's thought that using the brand new technology requires less effort. Perceived ease using social media is understood to be the extent that students think that using social media could be free from effort; the result of perceived ease of use of the social media on collaborative learning also perceived ease of use as you that a person thinks in the presence of an optimistic user performance relationship (Yampinij et al., 2012).

Perceived Usefulness: Perceived usefulness was understood to be ''the degree that an individual thinks that utilizing a specific system would increase his/her performance'' said Davis (1989). Perceived usefulness of utilizing social media will boost students' effectiveness within the class. Boulos et al. (2006) pointed that previous studies reveal that perceived usefulness helps in utilization of using social media on collaborative learning.

In this research, we aim to investigate the impact of these factors on users' social media usage and then implicitly collaborative learning.

Collaborative Learning

Positive Interdependence: Strijbos and De Laat (2010) depicted that individual responsibility and group cohesion correspond with two concepts that are central in collaborative learning: positive interdependence and individual accountability. Positive interdependence is the degree to which the performance of a single group member depends on the performance of other members. In other words, a higher level of positive interdependence can enhance cohesiveness. Cohesiveness can increase stability, satisfaction and efficient communication. With a more basic saying, positive interdependence aims to link group members together.

Individual Accountability: Strijbos and De Laat (2010) stated that individual accountability refers to the degree to which group members are held individually accountable for jobs, tasks or duties central to a groups' functioning. In other words, a higher level of individual accountability can enhance group members' individual responsibility for the group. As a better explanation, this term means whether the contribution of a group member has helped to achieve the group's overall goals.

Active Learning: Doyle et al. (2016) stated that active learning was enabled by social collaboration. For instance, asking questions of other learners, agreeing with other learners and explaining why, and sometimes disagreeing with other learners and explaining why. In short, active learning can be deemed as every action beyond just listening. In Doyle et al. (2016)'s research, active learning was the most instantiated collaborative learning characteristic for all of the classes. According to research of Tess (2013), it can be said that social software applications promote active participation. In this research, we aim to analyze whether social media usage makes one's usage of behaviors, knowledge and skills more active.

Group Processing: file sharing, messaging, meeting: An explorative interview study done by Hrastinski and Aghaee (2012) revealed that the students, that were almost all frequent social media users and also users of the traditional learning management systems, considered it as a complement to social media which they also think complements face to face education settings. They preferred social media for short communications and coordination while face to face meetings for longer communications such as group work. The benefits students reported of using social media is efficiency and time saving. In this research, we aim to analyze whether social media usage facilitates certain group processes like creation of groups, group participation and division of labor.

To explain the satisfaction level of using social media for collaborative learning, all of the dimensions of social media and collaborative learning are taken into consideration. We come up with a final model (Fig. 1) which represents all variables together with their relationship.

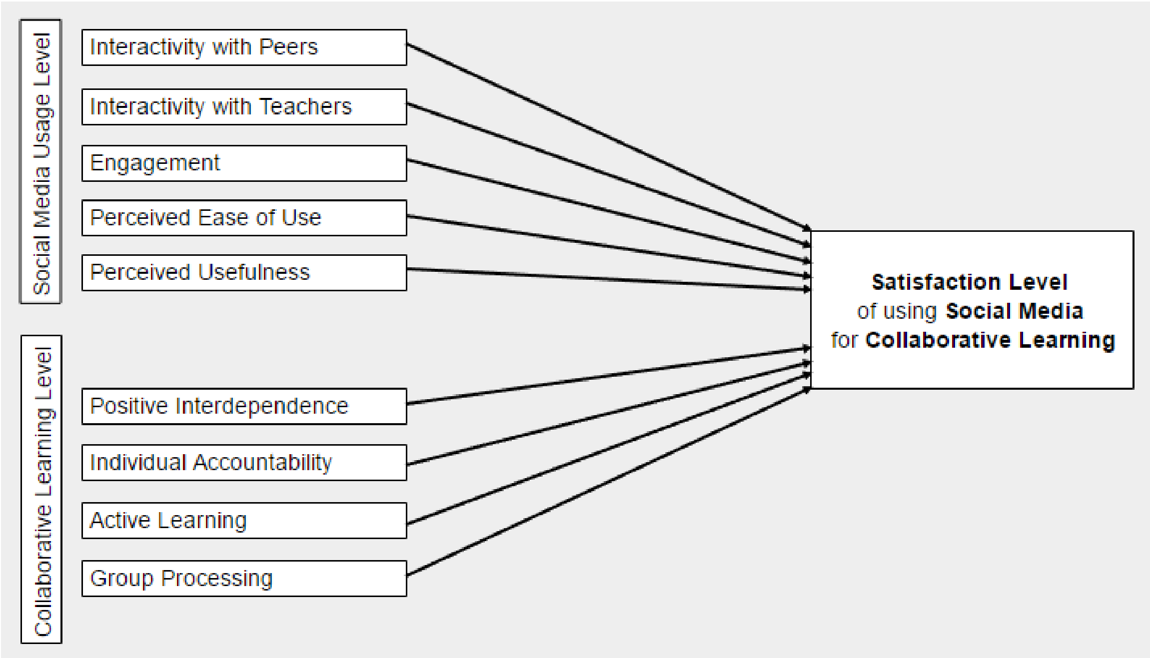

Figure 1. The research model

Data and Methodology

Collection of Data

Based on the literature review, a questionnaire is prepared to collect data and to test the research model. The first 3 questions of the survey are related to the demographics of the respondents including age, gender and educational level. Following questions are related to the factors of social media or collaborative learning depicted in the research model. To measure each factor several sub-questions based on the previous studies are asked. The last question is designed to measure the satisfaction level of using social media for collaborative learning. Each question is based on 7-point Likert-scale with preference scale (1: strongly disagree, 7: strongly agree).

The questionnaire in both Turkish and English is created via Google Forms and distributed through social media platforms during March 2017- May 2017. Totally 253 replies were made. After elimination of 3 of them due to missing values or inconsistencies, 250 replies were used in the analysis. It is assumed that the respondents have a reasonable level of experience with social media usage and collaborative learning since the questionnaire is distributed via social media itself. Also a general definition of collaborative learning is involved at the beginning of the survey.

Methodology

Multiple regression analysis is undertaken to investigate the level of social media usage for collaborative learning. The dependent variable is the last question of the questionnaire which directly measures the level of social media usage for collaborative learning. The independent variables are age, gender, educational level, and the factors of both social media usage and collaborative learning. Averages of variables under each dimension are calculated and used in the analysis. The categorical variable age is transformed to the continuous type variable by taking the midpoint of the 6 different age groups (Less than 18, 18-24, 25-34, 35-44, 45-54, 55 and over) and assign them newly created continuous age variable. In this way, we assume that this new variable may be more informative than a categorical variable. For the categorical variables gender and educational level, dummy variables are created and used in the regression analysis.

Findings

IBS SPSS Statistics 23.0 is used in order to analyze the collected data with Multiple Linear Regression method.

Descriptive Studies

In the sample, 30.4 % of the respondents are males, 68.8 % of the respondents are females and the rest 0.008 % of the respondents do not define themselves as male or female. Most of the respondents (69.2%) are between 18-24 ages, 30% of the respondents are over the age of 25 and the rest of the respondents (0.8 %) are less than the age of 18. 63.6 % of the respondents are undergraduate students, 23.2% of the respondents are graduates, 8.4% of the respondents are high school graduates and 4.8% of respondents are post graduates.

Regression Analysis

First, Pearson correlation test is applied to all the variables of the analysis. It is found that some variables are strongly correlated with each other. To eliminate multicollinearity problem Stepwise method is used to estimate multiple regression model coefficients. According to the results given in (Table 1), perceived usefulness, active learning, individual accountability and age are the significant variables of the satisfaction level of using social media for collaborative learning. Except age all they have positive impact on the satisfaction level.

Table 1. Coefficients[a]

Model	Unstd. Coefficients B	Unstd. Coefficients Std. Error	Std. Coefficients Beta	t	Sig.	Collinearity Statistics VIF
(Constant)	1.014	.352		2.884	.004	
AVG_PERCEIVEDUSEFULLNESS	.661	.049	.619	13.445	.000	2.389
AVG_ACTIVELEARNING	.232	.047	.226	4.895	.000	2.407
AVG_INDIVIDUALACCOUNTABILITY	.129	.039	.129	3.334	.001	1.679
Age	-.040	.013	-.091	-2.987	.003	1.042

a. Dependent Variable: SATISFACTION

Table 2. Model summary and ANOVA table

Model	R	R Square	Adj. R Square	SE Estimate	F	Sig.	Durbin-Watson
4	.885	.783	.779	.8692	220.39	.000	2.032

R Square value in Table 2 shows that the change in the satisfaction level of the people who use social media for collaborative learning is related with perceived usefulness, individual accountability, active learning and age with the percentage of 78.3%. Beta coefficients of the variables show that the most important variable in explaining the variability of the the satisfaction level of social media usage for collaborative learning is perceived usefulness, then active learning, individual accountability, and age respectively.

Other assumptions of the regression analysis are checked. The Durbin-Watson statistic (D-W=2.032) is used to detect the autocorrelation problem. According to the results of the test there is no autocorrelation in the residuals of the model. The P-P plots of the residuals and Skewness and Kurtosis values of residuals ensure that the residuals are normally distributed. Moreover, Homoscedasticity assumption has been met which is controlled by the Spearman Rank correlation test.

Conclusion

On the basis of the purpose of this study which was to analyze the satisfaction level of the people using social media for collaborative learning, we firstly define several variables that might affect people's social media usage level and collaborative learning level. In addition to these, we also aimed to understand better behavioral distinctness of people with different age, gender and educational levels.

Data are collected through social media platforms. The respondents are students or graduates of public or private educational institutions with different educational levels. According to regression analysis results, it has been found that the change in the satisfaction level of the people who use social media for collaborative learning is related with perceived usefulness, individual accountability, active learning and age.

While comparing this study with the previous ones, it can be said that some results are intriguing. For instance, only perceived usefulness dimension of the social media usage level and only individual accountability and active learning dimensions of collaborative learning level affecting the satisfaction level. As a reason we can assert that there may be still limited usage of social media for collaborative learning. Among the demographic characteristics of people the only significant variable is age. As it is expected, the results show that the social media usage for collaborative learning is popular among younger students. In contrast there is no difference in the satisfaction level of social media usage with respect to gender and different educational levels. For a better explanation of the study, sample can be extended in different age and educational level categories, therefore the analysis can be interpreted with a deeper comprehension.

For further studies, providing variety in participants may give more meaningful outputs. Moreover, instead of the satisfaction, other concepts like academic success and motivation of the people using social media for collaborative learning activities can be evaluated and interpreted.

References

Alkhathlan, A. A., & Al-Daraiseh, A. A. (2017). An analytical study of the use of social networks for collaborative learning in higher education. *International Journal of Modern Education and Computer Science*, 9(2), 1-13.

Al-Rahmi, W. M., & Othman, M. S. (2013). Evaluating student's satisfaction of using social media through collaborative learning in higher education. *International Journal of Advances in Engineering & Technology*, 6(4), 1541-1551.

Al-Rahmi, W. M., Othman, M. S., & Yusuf, L. M. (2015). The Effect of Social Media on Researchers' Academic Performance through Collaborative Learning in Malaysian Higher Education. *Mediterranean Journal of Social Sciences*, 6(4), 193-203.

Boulos, M. N. K., Maramba, I., & Wheeler, S. (2006). Wikis, blogs and podcasts: a new generation of Web-based tools for virtual collaborative clinical practice and education. *BMC Medical Education*, *6*(41), 1-8.

Chretien, K. C., Greysen, S. R., Chretien, J. P., & Kind, T. (2009). Online posting of unprofessional content by medical students. *Jama*, *302*(12), 1309-1315.

Dabbagh, N., & Reo, R. (2011). Back to the future: tracing the roots and learning affordances of social software. In M. J. W. Lee & C. McLoughlin (Eds.), *Web 2.0-based e-learning: applying social informatics for tertiary teaching* (pp. 1-20). IGI Global.

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13(3), 319-340.

Dillenbourg P. (1999). What do yuo mean by collaborative leraning?. In P. Dillenbourg (Ed) C*ollaborative-learning: cognitive and computational approaches* (pp.1-19). Oxford: Elsevier.

Doyle, C., Neville, K., & Sammon, D. (2016). Evaluating the effectiveness of social media enabled collaborative learning environments (SMECLEs). *Journal of Decision Systems, 25*(1), 106-124.

Edosomwan, S., Prakashan,S. K., Kouame, D., Watson, J., & Seymour, T. (2011). The History of Social Media and Its Impact on Business. *Journal of Applied Management and Entrepreneurship*; 16(3) , 79-91.

Fewkes, A. M., & Mccabe, M. (2012). Facebook: learning tool or distraction? *Journal of Digital Learning in Teacher Education, 28*(3), 92-98.

Frye, E. M., Trathen, W., & Koppenhaver, D. A. (2010). Internet workshop and blog publishing: meeting student (and teacher) learning needs to achieve best practice in the twenty-first-century social studies classroom. *The Social Studies, 101*(2), 46-53.

Gruzd, A., Wellman, B., & Takhteyev, Y. (2011). Imagining Twitter as an imagined community. *American Behavioral Scientist*, *55*(10), 1294-1318.

Gruzd, A., Staves, K., & Wilk, A. (2012). Connected scholars: Examining the role of social media in research practices of faculty using the UTAUT model. *Computers in Human Behavior, 28*(6), 2340-2350.

Hrastinski, S., & Aghaee, N. M. (2012). How are campus students using social media to support their studies? An explorative interview study. *Education and Information Technologies*, *17*(4), 451-464.

Junco, R., Heiberger, G., & Loken, E. (2011). The effect of Twitter on college student engagement and grades. *Journal of Computer Assisted Learning*, *27*(2), 119-132.

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of social media. *Business Horizons*, *53*(1), 59-68.

Liao, Y. W., Huang, Y. M., Chen, H. C., & Huang, S. H. (2015). Exploring the antecedents of collaborative learning performance over social networking sites in a ubiquitous learning context. *Computers in Human Behavior*, *43,* 313-323.

Liu, C. C., Liu, K. P., Chen, W. H., Lin, C. P., & Chen, G. D. (2011). Collaborative storytelling experiences in social media: Influence of peer-assistance mechanisms. *Computers & Education*, *57*(2), 1544-1556.

Maloney, E. (2007). What Web 2.0 can teach us about learning. *Chronicle of Higher Education*, *53*(18).

Strijbos, J., & De Laat, M. F. (2010). Developing the role concept for computer-supported collaborative learning: An explorative synthesis. *Computers in Human Behavior, 26*(4), 495-505.

Tess, P. A. (2013). The role of social media in higher education classes (real and virtual) – A literature review. *Computers in Human Behavior, 29*(5), A60-A68.

Top, E. (2012). Blogging as a social medium in undergraduate courses: Sense of community best predictor of perceived learning. *The Internet and Higher Education, 15*(1), 24-28.

Van Dijck, J. (2013). *The culture of connectivity: A critical history of social media*. Oxford University Press.

Wolf, M. M., Wolf, M., Brady, L., Peszynski, H., Higgins, L., & Wolf, S. (2012). Using social media for collaborations about industry news in higher education. *American Association of Wine Economists: Princeton, NJ, 1.*

Yampinij, S., Sangsuwan, M., & Chuathong, S. (2012). A conceptual framework for social network to support collaborative learning (SSCL) for enhancing knowledge construction of grade 3 students. *Procedia - Social and Behavioral Sciences, 46*, 3747-3751.

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The Eurasia Proceedings of Science, Technology, Engineering & Mathematics (EPSTEM)
ISSN: 2602-3199

The Eurasia Proceedings of Science, Technology, Engineering & Mathematics (EPSTEM), 2018

Volume 9, Pages 323 - 326

ICRES 2018: International Conference on Research in Education and Science

A Design of Android Based Mobile Application for Determination of Learning Style

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Abstract: In this study an android based mobile application is designed for determining Learning Styles of the individuals. Easy, rapid and efficient learning is very important for each individual that affects their success in business and daily life. As long as life-long learning continues, the importance of recognizing the individuals learning abilities becomes more important. The aim of this study is to make individuals be aware of their abilities on the way of easy learning by using the proposed mobile application which can be executed on Android based mobile devices. As the technology evolves, the use of mobile devices has become inevitable. Most of the individuals use smart phones for many different aims such as communication, entertainment and learning. Hence commonly usage of mobile devices makes the proposed system more practical. By simply downloading the proposed application to the mobile device, individuals will be able to run the program. The proposed sytem is designed and developed by usig Java Android programming.

Keywords: Learning style, Mobile application

Introduction

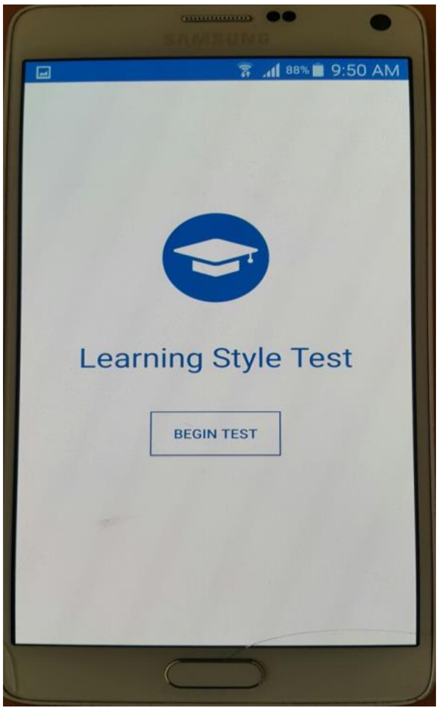
Individuals can have different capabilities in way of learning, thinking and searching [1]. By considering this, it is thought that, recognition of individuals about their own learning skills is getting importance in easy and rapid learning. When the efficient way of learning is applied by the individuals, their successes in business, academic or daily life also increases accordingly. Many number of learning styles have been developed by the researchers to help individuals recognize their own learning skills [2].

In [3], differences in individual's way of perceiving, remembering, thinking, and problem solving is discussed. While in [4], learning styles are considered as an extension of cognitive styles, in [5] learning styles are supposed to be grounded on psychological basis. There are many different approaches in classifying learning styles in literature [5-8]. In our previous studies [9-11], learning styles are inferenced by using fuzzy logic technique and also different learning styles which are proposed by Gregorc, Dunn and McCarthy are used in these studies.

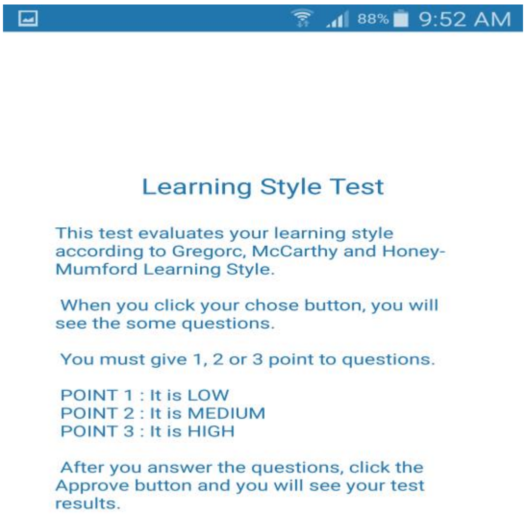
In this study, learning style of the individual is inferenced by using mobile devices. As the evolvements in mobile technology, usage of mobile devices and number of applications increase expectedly. By downloading and executing the proposed application, individuals answer related questions and the system inferences the learning styles of the individuals. In rest of the paper, the design of the Android based Mobile Application which includes interfaces of the system is determined in detail and future studies are mentioned in Conclusion Section.

Design of Android Based Mobile Application

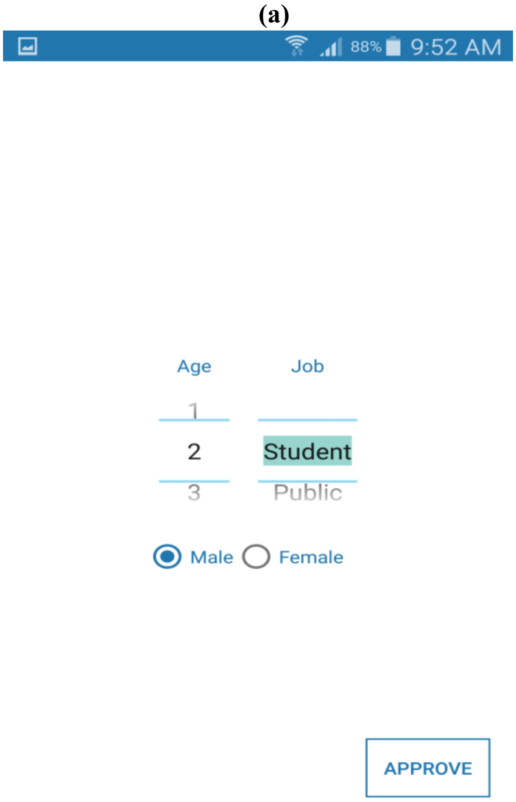
As the mobile applications attract attention day by day, the usage of mobile devices increases in accordance with this evolvement. This study proposes mobile application which inferences the most convenient learning style for the individual who answers related questions included in the interfaces. Figure 1 represents the interfaces of developed Android based Mobile Application.


88% 9:50 AM
Learning Style Test
BEGIN TEST

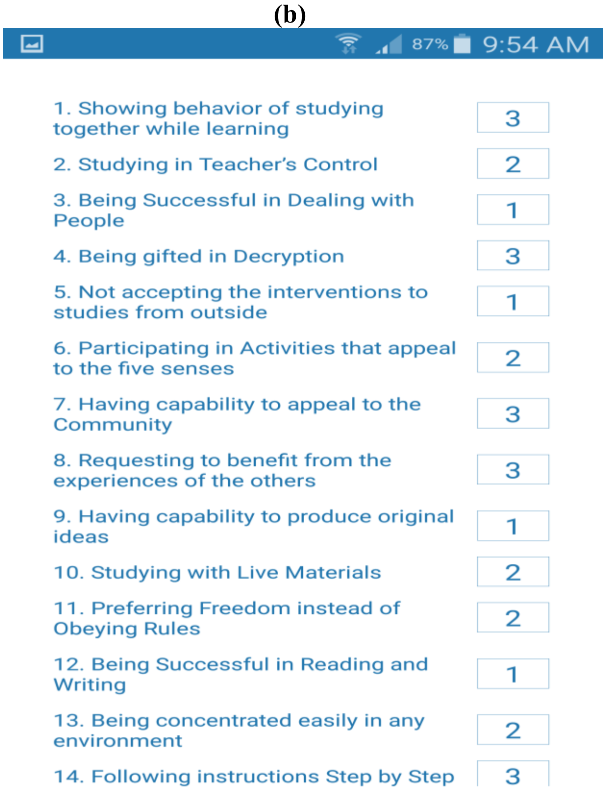
(a)


88% 9:52 AM
Learning Style Test
This test evaluates your learning style according to Gregorc, McCarthy and Honey-Mumford Learning Style.
When you click your chose button, you will see the some questions.
You must give 1, 2 or 3 point to questions.
POINT 1 : It is LOW
POINT 2 : It is MEDIUM
POINT 3 : It is HIGH
After you answer the questions, click the Approve button and you will see your test results.

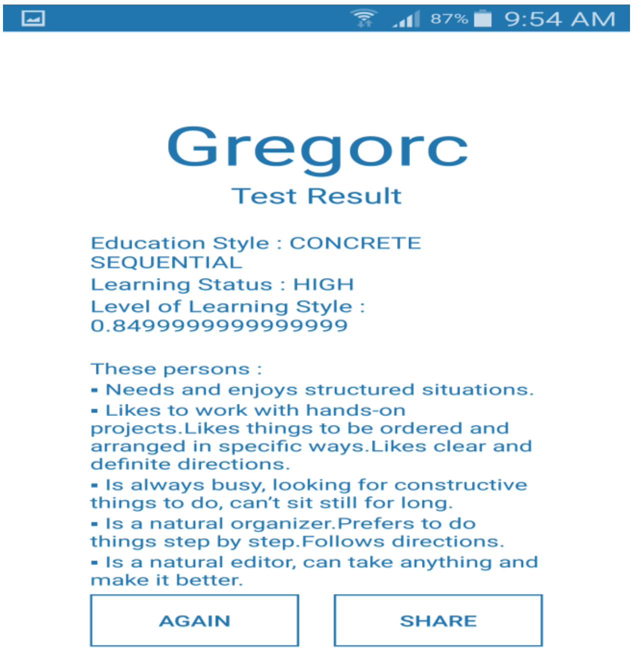
(b)


88% 9:52 AM
Age
Job
1
2
Student
3
Public
Male
Female
APPROVE

(c)


87% 9:54 AM
1. Showing behavior of studying together while learning 3
2. Studying in Teacher's Control 2
3. Being Successful in Dealing with People 1
4. Being gifted in Decryption 3
5. Not accepting the interventions to studies from outside 1
6. Participating in Activities that appeal to the five senses 2
7. Having capability to appeal to the Community 3
8. Requesting to benefit from the experiences of the others 3
9. Having capability to produce original ideas 1
10. Studying with Live Materials 2
11. Preferring Freedom instead of Obeying Rules 2
12. Being Successful in Reading and Writing 1
13. Being concentrated easily in any environment 2
14. Following instructions Step by Step 3

(d)



(e)

Figure 1. Interfaces of the proposed mobile system

When the individual executes the proposed application, main screen which is shown in Figure 1.a is met by the individual. After the individual clicks on Begin Test button, some information about the usage of the system is given as shown in Figure 1.b. As it can be seen in Figure 1.c, individual enters demographic information which is consist of age, job and gender parameters. After this information is approved, individuals answer the questions by entering points between 1 and 3 as shown in Figure 1.d. Finally, the proposed system inferences the best convenient learning style for individual and shows it on the screen as can be seen in Figure 1.e.

Conclusion

In this study, A Design of Android Based Mobile Application for Determination of Learning Style is proposed. Recent developments and increments in usage of mobile technology constitute the motivation of this study. By using the proposed system, the individuals will be able to download the application to their smart devices and following this they will give answers to the related questions. At the end, the system will inference the best convenient learning style to the individual and will show the result on the screen of smart device. In future studies, a survey is planned to be applied to the individuals and the results will be analyzed by using SPSS statistical package program.

Acknowledgement

We are very thankful to Serkan Yarar for his support in implementing the Android programming part of the project.

References

Z. Ghazivakili, R. N. Nia, F. Panahi, M. Karimi, H. Gholsorkhi, and Z. Ahmadi, The role of critical thinking skills and learning styles of university students in their academic performance, J Adv Med Educ Prof 2 (2014), 95–102.

E. €Ultanır, Y. G. €Ultanır, and G. €O. Temel, The examination of university students' learning styles by means of Felder-Silverman index, Educ Sci 37 (2012), 29–42.

Y. Liu and D. Ginther, Cognitive styles and distance education. Online Journal of Distance Learning Administration, Volume II, Number III, Fall 1999 State University of West Georgia, Distance Education.

K. Logan and P. Thomas, Learning Styles in Distance Education Students Learning to Program. 14th Workshop of the Psychology of Programming Interest Group, Brunel University, June 2002 www.ppig.org

K. Sabry and L. Baldwin, Web-based learning interaction and learning styles, Brit J Educ Technol 34 (2003), 443–454.

A. Nikolaou and M. Koutsouba, Incorporating 4MAT model in distance instructional material—An innovative design, Eur J Open Dist E-Learning 16 (2012), 50–63.

A. Susan, Influence of Learning Styles and Personality on Distance Learning, Santo University of South Dakota, Vermillion, SD, USA, TCC 2005, Online Conference.

T. C. DeBello, Comparison of eleven major learning styles; variables, appropriate populations, validity of instrumentation and the research behind them. J Read Writ Learn Disabil Int 6 (1990), 203–222.

A. Ozdemir, A. Alaybeyoglu, N. Mulayim, K.F. Balbal, Performance Evaluation of Learning Styles Based on Fuzzy Logic Inference System, Computer Applications in Engineering Education, pp:853-865.

A. Ozdemir, A. Alaybeyoglu, K.F. Balbal, Learning Style Determination with Gregorc Learning Style Model: Example for Faculty of Engineering, ICRES 2017.

K.F. Balbal, N. Mulayim, A. Ozdemir, A. Alaybeyoglu, Fuzzy Logic Based McCarthy Learning Style Inference System, ICRES 2016.

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The Eurasia Proceedings of Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 327 - 330

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Examining the In-Service Needs of Social Studies Teachers in the Field of Teaching Technology

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Abstract: This study was conducted in order to determine what social studies teachers in secondary schools need to learn in in-service training activities and what they need in educational technology. This research was carried out by 14 social studies teachers (6 female - 8 male) who participated in in-service training activities in the Gaziantep Provincial Nizip District. This study was conducted with semi-structured interview technique from qualitative research methods. According to the findings obtained in the research, it was determined that the trainers who took part in these activities were not at the level of sufficient expertise. Nevertheless, they pointed out that these activities are scarce and not perfectly suitable. Some of the participants stated that they combine knowledge and technology through these technology trainings. The recent in-service courses say that those who are related to technology are usually under the title of the conqueror project. The use of technology in education has led to the conclusion that in-service courses are very useful for effective use of instructional materials. On the basis of these results, suggestions have been made that necessity analysis should be done before the in-service courses are made.

Keywords: Social studies teachers, In-service training

Introduction

Turkey Archive and Technology Improvement Act (Fatih) Project qualification of teachers on instructional technology in Turkey with the start of the promotion and revision in 2010 has become even more important. Since 2011, under the FATIH Project, interactive board installations have been carried out in all the public school classes. Within the scope of the project, each teacher and student is provided with a tablet computer. One of the most important elements of the process of integration (integration) of technology in teaching environments in the summer is stated as being a teacher. (Sarıtepeci & Seferoğlu, 2016). The teacher, who is the most basic element of the education system, also creates the driving force for change in the society. Every change in the education system takes place within this power. First of all, is dependent on the life-long learning process of the teachers who raise the human power necessary to reach the educational goals. It is possible for teachers to adapt to the developments in their professions and to be productive and productive by means of in-service training programs to be provided to them (Montenegro, 2015; Koçoğlu, 2013; Koçoğlu, 2014). There is general consensus that the most important factor in providing quality education to schools is teachers. For this reason, there is a significant contribution to the development of the education system and the success of the student, which supports the professional development of the teachers (Knudsen, Hadzibegovic-Bubanja, Nielsen, Petkova & Nikolovska, 2013; Koçoğlu, 2015). In the basic research on the effectiveness of in-service training, the factors affecting the in-service training are: determining the needs before in-service training, informing the trainees about the course before in-service training, careful selection of the trainee teacher, how long in-service training will be done, the physical characteristics of the place where the trainings will be given, the educational contents of the in-service training courses, what kind of achievements the in-service training trainees have and whether they transfer these achievements to the implementation units, the follow-up of in-service trainees and the provision of training support and evaluation of in-service trainings (Yıldırım, Kurşun, & Göktaş, 2015 Ulu Kalin, 2017a).

When the literature is examined, it has been determined that a limited number of in-service training courses are organized for the use of technology and that the organized courses are mainly focused on technical dimensions

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such as hardware and software and that the needs of teachers can not be met adequately in these courses (Güven & Yılmaz, 2016; Ulu Kalin, 2017b; Hacat, 2018a). It is not enough, however, to provide only technical information in the in-service training courses to be organized for the use of technology. In addition to this, Technological Pedagogical Content Knowledge (TPACK) should be included in which technology, subject area and how to use it. In addition, the relationship between technology and curriculum should not be ignored in organized curriculum. For this reason, a number of case studies need to be held in order to provide teachers with technology information that is compatible with the curriculum and to gain experience with how to use technology in mathematics lessons (Akman & Güven, 2015a; Akman & Güven, 2015b; Hacat, 2018b). Another noteworthy aspect of in-service training courses is that the course programs are not based on any model. However, when the literature is examined, it is seen that there are many models developed for technology integration (Rieber & Welliver, 1989; Rogers, 2003).

The limitations of the literature in our country in the field of special education are summarized above, as it is possible that the in-service training of teachers can be developed within the framework of existing competencies by targeting them in a targeted way. However, determining the in-service training needs is also important in other respects. Changing teacher competencies force teachers to have knowledge and skills in different fields and subjects. Even though teacher training in teacher education policy, although Turkey has a long past 150 years have changed for various reasons. (Karasu, Aykut & Yilmaz, 2016). As in all areas, it has become a necessity to adapt to changes and developments in the field of education and to achieve the expected standard. Achieving the purpose of the updated training programs will also be possible by meeting the professional needs of the teachers. Therefore, the need analysis of teachers and the effective implementation of the programs to be developed accordingly will enable the teachers to acquire the qualifications that conform to the standard expected from them (Kösterelioğlu & Özen, 2014). In this study; social studies teachers working in secondary schools were carried out in order to determine what they needed in educational technology and what needs to be learned through in-service training activities. Depending on the purpose of the study, the following sub-problems were sought:

1. Do you participate in in-service trainings on social studies teaching in your professional life? If so, how well do you think these trainings are enough?
2. What are the problems faced by teachers in relation to the use of technology in teaching during the implementation of the FATIH project?
3. What recommendations can be made to increase the quality of in-service training for social studies teaching?

Method

This section includes; the study group, the data collection tools, and analyzes of the data.

The desire of your research

The research is structured with a qualitative approach. In this study descriptive analysis technique was used from qualitative research types.

Working group

The data of this research is given in the fall semester of 2017-2018 in Gaziantep Province Nizip Provincial Department of Social Sciences teaching in secondary schools attached to the Ministry of National Education; (6 women-8 men) who were selected for the purpose.

Data Collection Tools

The data of the study were obtained by asking three open-ended semi-structured.

Analysis of Data

In this study, collected data were analyzed using descriptive analysis technique from analysis techniques in qualitative research methods. The purpose of descriptive analysis is to introduce a format in which raw data can be read and used by readers. The data obtained in the descriptive analysis are summarized and interpreted according to the previously determined theme. In this analysis, direct citation is often given in order to reflect the views of the individuals seen or observed in a striking way (Yıldırım & Şimşek, 2005).

Findings and Comments

Findings and interpretations for the first subproblem

Have you participated in in-service trainings on social studies teaching in your professional life? If so, how well do you think these trainings are enough? In spite of the fact that teachers say that the majority of teachers do not participate in in-service training on social studies teaching, according to their views on participation in in-service training for social studies teaching and the level of competence of in-service training. Teachers participating in in-service training stated that they found these trainings to be "partly sufficient" for the majority of them. At the same time, it was determined that the trainers who took part in these activities were not at the level of sufficient expertise. Nevertheless, they pointed out that these activities are scarce and not perfectly suitable.

Findings and interpretations for the second subproblem

What are the problems faced by the teachers in relation to the use of technology in teaching during the implementation of the FATIH project? Asked, the teachers indicated that the most important need that emerged with the implementation of the FATIH project was "technical support / technical staff needs". The other two teachers' views frequently expressed under the in-service training category are "Increasing the level of consciousness of teachers and students especially about the use of technology" and "Being informed of the students". Other teacher views on in-service training needs include providing training on teaching methods and techniques, providing teachers with information on new technologies and eliminating deficiencies in technology integration.

Findings and interpretations for the third subproblem

What suggestions can you make to increase the quality of in-service training for social studies teaching? In order to answer this question, teachers presented suggestions in the form of practical in-service trainings on in-service training, giving them to field specialists, arranging them in suitable places, arranging them at weekends, between semesters or summer holidays and in appropriate settlement areas. In addition to this, among the suggestions that social educators offer in order to increase the quality of in-service trainings, in-service trainings made in small groups, more frequent performances, opinions from teachers, arrangement of teachers according to their needs and sharing of information obtained after trainings It is located.

Conclusions and Recommendations

The results obtained from the research revealed that the vast majority of social science teachers did not receive in-service training related to social studies teaching and the vast majority of teachers in the in-service training found that they received "partially satisfactory" training. According to the findings of the research, the main issues that teachers most need in handling in-service training are; The use of technology in education, the use of the Internet for educational purposes, and the effective use of instructional materials. As a result of social work, teachers of social studies have shown that in-service training is not an appropriate time. Teachers stated that the in-service trainings made during the education period cause them to interrupt their courses and that they can not get the efficiency from the in-service trainings due to the heavy workload. In addition, problems such as inadequate in-service training and not providing these trainings to field specialists are among the important problems experienced by classroom teachers in in-service training.

Acknowledgements

This work was presented at the International Conference on Education in Mathematics, Science and Technology (ICEMST).

References

Akman, O., & Guven, C. (2015a). Analysis of TPACK Self-Efficacy Perception Levels of Social Studies Teachers and Pre-Service Teachers. *International Journal of Contemporary Educational Research*, *2*(1), 1-12.

Akman, Ö., & Güven, C. (2015b). TPACK Survey Development Study for Social Sciences Teachers and Teacher Candidates. *International Journal of Research in Education and Science*, *1*(1), 1-10.

Güven, B., & Yılmaz, G. K. (2016). Tasarlanan hizmet-içi eğitim kursunun ortaokul matematik öğretmenlerinin teknoloji kullanım düzeylerine etkisi. *Eğitim ve Bilim*, *41*(188).

Hacat, S. O. (2018a). Assessment of the Basic Law Lesson Consistent with the Opinions of Social Studies Pre-Service Teachers. *International Journal of Higher Education*, *7*(1), 103-110.

Hacat, S. O. (2018b). Opinions of Middle School Students on the Justice Concept within the Framework of Social Studies Education. *International Journal of Higher Education*, *7*(2), 210.

Kalın, Ö. U. (2017b). Analysis of 7 th Grade Social Studies Course Book According to Different Readability Formulas. *International Online Journal of Educational Sciences*, *9*(4).

Karadağ, R. (2015). Sınıf Öğretmenlerinin Türkçe Öğretimine Yönelik Hizmet İçi Eğitimlere İlişkin Görüşleri ve Hizmet İçi Eğitim Gereksinimleri. *İnönü Üniversitesi Eğitim Fakültesi Dergisi*, *16*(3).

Karasu, N., Aykut, Ç., & Yilmaz, B. (2014). Zihin engelliler öğretmenlerinin hizmet içi eğitim ihtiyaçlarının belirlenmesi. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi*, *15*(01), 041-053.

Knudsen, H. J., Hadzibegovic-Bubanja, E., Nielsen,S., Petkova, E. & Nikolovska, M. (2013). School-based İnservice teacher training in Montenegro. A handbook for policy makers and practitioners. Luxembourg: Publications Office of the European Union.

Koçoğlu, E. (2013). Sosyal Bilgiler Öğretmen Adaylarının, Okul Yöneticilerinde Olması Gereken Demokratik Tutum Ve Davranışlara İlişkin Görüşleri. *Electronic Turkish Studies*, *8*(6).

Koçoğlu, E. (2014). Sosyal Bilgiler Dersi Kazanımlarının Kültürel Yaşam Üzerindeki Etkilerine İlişkin Öğretmen Algıları. *Mediterranean Journal of Humanities (mjh. akdeniz. edu. tr) IV/2*, 191-204.

Koçoğlu, E. (2015). Social Studies Teachers' Perspective of Religion Education in Turkey. *International Online Journal of Educational Sciences*, *7*(1).

Kösterelioğlu, İ., & Özen, R. (2014). Sınıf öğretmenlerinin sosyal bilgiler dersi öğretim programını uygulamaya yönelik hizmet içi eğitim ihtiyaçları. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi*, *14*(1).

Rieber, L. P. ve Welliver, P. W. (1989). Infusing educational technology into mainstream educational computing. International Journal of Instructional Media, 16(1), 21-32

Rogers, E.M. (2003). Diffusion of Innovation (5th ed.). New York: The Free Press

Sarıtepeci, M., Durak, H., & Seferoğlu, S. S. (2016). Öğretmenlerin Öğretim Teknolojileri Alanında Hizmet-İçi Eğitim Gereksinimlerinin FATİH Projesi Kapsamında İncelenmesi 1. *Turkish Journal of Computer and Mathematics Education*, *7*(3), 601.

Ulu Kalin, Ö. (2017a). Creating Interactive Student Workbook for Primary Education Social Studies Class and Researching Its Efficiency. *Journal of Education and Practice*, *8*(12), 33-40.

Yıldırım, A. ve Şimşek, H. (2005) Sosyal Bilimlerde Nitel Araştırma Yöntemleri. (2. baskı). Ankara: *Seçkin yayıncılık*.

Yıldırım, Ö., Kurşun, E., & Göktaş, Y. (2015). Bilgi ve iletişim teknolojileri konusunda yapılan hizmet içi eğitimlerin niteliğini etkileyen faktörler. *Eğitim ve Bilim*, *40*(178).

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ISRES Publishing

The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 331 - 343

ICEMST 2018 : International Conference on Education in Mathematics, Science and Technology

Teaching the Unit 6 in Academic Program of Science and Technology on 8th Grade "Matter Cycles, Recycle and Energy Sources" and Their Effect on Students' Environmental Consciousness (An Izmir City Case Study)

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Abstract: In this study, the impact of the particular subject, which is covered as the sixth chapter in Science and Technology course of the eighth grade, "Matter Cycles, Recycle and Energy Resources" on students' environmental awareness was investigated. At the same time, the effectiveness of the studies which are practiced in the schools in line with the relevant achievements determined by the Ministry of National Education is examined. The survey method was used. The sample contains eight grade students (n=1600) from eighteen schools in Izmir. The data were collected by applying the "Environmental Consciousness Scale" developed by the researcher. Data analysis is made by using SPSS 15:00 Data Analysis Package Programme. According to the results, the environmental consciousness state of the students is turned out to be close to high. It is found that the students are successful in recycling and water saving, but they are dubious about how economical biofuels, acid rains, sun and wind energy are. It is found that female students' environmental consciousness is more than male students' and the awareness level has been different as their schools change. It is understood that the children of high-income level families have a higher level of environmental consciousness than the others. It is found that the education levels of the parents are significantly affecting the level of environmental awareness of the students. Finally, it has been concluded that when the students" academic success level goes up, their environmental consciousness level goes up.

Keywords: Environmental consciousness, Matter cycles, Recycle, Energy resources, Primary education

Introduction

The Environment consists of living and non-living elements. The non-living elements of the environment are humans, plants, microorganisms; non-living elements consist of air, water, geographical formations, buildings and bridges which are both natural and also manmade objects.

Albert Einstein, by describing the environment as "everything outside of me"; emphasizes that the concept of the environment actually has a very broad meaning. (Miller and Spoolman,2010)

As the living elements of the environment; we can mention plants, animals, and people. Non-living elements, on the other hand, are anything but living things, such as water, earth, air, underground sources, and climate. The living and non-living things that make up the environment must be in harmony with each other. According to the natural selection principle of Charles Darwin, those who cannot adapt to environmental conditions cannot continue their lives, they are eliminated from nature.

In terms of cognitive advantages, the human is different from other elements in the environment. From time to time, he may feel himself superior to other things and he can consume other elements unconsciously for their own interests or occupy the living space of other creatures. This wrong attitude and behavior cause environmental problems. It is human to love and protect the environment as well as to harm the environment.

Raising people who have awareness about the environment and who are sensitive to environmental problems is possible with education.

Method

1. Purpose

The purpose of this study is to investigate the impact of the students' environmental consciousness on the topics of "Cycles of Materials, Recycling and Energy Sources" in the 6th Unit of the 8th Grade Science and Technology Curriculum. Additionally, internalization levels of the students the educational attainments, which are determined by the Ministry of Education at the beginning of the semesters, are examined.

Problem

Will the students' consciousness level of environmental issues and their interests to environment increase; when the learning process of the topics "Cycles of Materials, recycling, and energy sources" which are in the 6th Unit of 8th grade Science and Technology curriculum is completed?

Sub Problems

1. Is there any significant difference between students‟ environmental consciousness and
   a. Gender
   b. The education level of the parents
   c. Socioeconomic situation of the parents
   d. Schools‟ TEOG Exam success rating?
2. Is there any meaningful correlation between students‟ environmental consciousness and students‟ TEOG Exam success ratings?

2. Research Model

In this study, "survey" which is among descriptive research method, is used. In the study, the environmental consciousness levels of the students were assessed before and after the "Living and Energy Relations" unit of the 8th grade Science and Technology lesson focusing on the environmental topics. Therefore, the field survey method was used, the sample was enlarged and the study aimed to represent the Izmir province.

Sample

The target population of the study is limited to 8th-grade students of public schools affiliated to 9 metropolitan provinces, namely Balçova, Bayraklı, Bornova, Buca, Gaziemir, Karabağlar, Karşıyaka, Konak, and Narlıdere. Taking into account the results of the 2015 TEOG (January) examinations, two schools were selected from each of the provinces mentioned above, with high and low success rankings. These eighteen state schools, selected for the sample of the study, constitute 8th-grade students in the 2015-2016 school year (n = 1600).

Instrument and Data Analysis

The "Environmental Consciousness Scale" to be used for data acquisition was developed by the researcher.
The scale was applied to 9th-grade students of İzmir Girls High School in order to measure the degree of reliability of their materials (n = 230). As a result of the analyses made, five items with low-reliability coefficient were removed from the test. Thus, the reliability coefficient of the scale increased from 84 to 86. The items extracted from the scale do not distort the content validity.

The prepared scale was applied twice, before and after the "Life and Energy Relations" unit of Science and Technology Course to the 8th-grade students who constituted the study group.

Analysis of the obtained data was done with SPSS 15.00 Data Analysis Package Program.
Students‟ personalities and environmental consciousness are compared. While comparing, independent t-test, variation analysis, and simple correlation were used.

1. An independent t-test was used to determine whether the students' scores on the "Environmental Consciousness Scale" differed significantly by sex.
2. Whether the scores that students get from “Environmental Consciousness Scale” show significant difference according to followings:
2.1. Mother and father‟s education level
2.2. Mother and father‟s socioeconomic conditions
2.3. School‟s success rankings in TEOG was determined by using One Way Anova analysis.
3. Whether or not there is a relationship between the TEOG test success of schools and environmental consciousness of students, is determined by simple correlation technique.

Results

1. Overall Performance in the Applied Scale

In the “Environmental Consciousness Scale” that is applied to the students and prepared based on five point Likert scale, there are 17 positive, 14 negative statements. For the statements: " strongly disagree", " undecided", "agree", " strongly agree", students mark one of them, thus indicating their agreement-disagreement degree to the attitude object covered by each statement in the scale.
The score a student gets from the scale is the sum of the scores he/she receives from the items on the scale.

Table 1. Rating key of the ıtems in a likert type scale

Option	Positive Statement Point	Negative Statement Point
Strongly Disagree	1	5
Disagree	2	4
Undecided	3	3
Agree	4	2
Strongly Agree	5	1

According to the scoring system described in table 1, a student can be interpreted as successful on the items she/he gets "5 points", unsuccessful on the items she/ he gets "1". This is valid for all positive and negative statements. A student with a high environmental consciousness is expected to score "5" on given statements.
When the frequency table of each item is analyzed separately in data analysis, the highest frequency for the items; "5" is given for twenty seven items, "4" is given for one item and "3" is given for three items. According to this finding, it can be said that the students are successful in the applied scale.
Two of the three items that students “are undecided” with the highest frequency, relate to renewable energy sources (items 25, 30 and 31).
Item 25 states that "forest resources do not develop parallel with the production of paper in our country." Table 2 gives the distribution of the answers students have given to this item.

Table 2. The distribution of the answers that students have given to item 25

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	1,00	128	8,0	8,0	8,0
	2,00	122	7,6	7,6	15,6
	3,00	480	30,0	30,0	45,7
	4,00	414	25,9	25,9	71,5
	5,00	455	28,4	28,5	100,0
	Total	1599	99,9	100,0	
Missing	System	1	,1		
Total		1600	100,0		

According to Table 2, 480 out of 1600 students, that is 30% of the students, answered the 25th item as "undecided". These students had difficulty in establishing a relationship between paper production and forest resources.

Item 30 "The widespread use of biofuels (organic fuels) derived from seed, sugar and vegetable oil or their mixture can prevent the environmental problems." The distribution of responses of the students to this item is given in Table 3.

Table 3. The distribution of the answers that students have given to item 30

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	90	5,6	5,6	5,6
	2,00	89	5,6	5,6	11,2
	3,00	500	31,3	31,3	42,4
	4,00	445	27,8	27,8	70,3
	5,00	476	29,8	29,8	100,0
	Total	1600	100,0	100,0	

According to Table 3, 500 out of 1600 students, that is 31.3% of the students, answered the item 30 as "undecided". This suggests that students do not have enough information about organic fuels.
Item 31 states that "I do not find wind turbines and energy production economical because there will not be enough winds in all seasons." The distribution of students' responses to this item is given in Table 4.

Table 4. The distribution of the answers students have given to item 31

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	207	12,9	12,9	12,9
	2,00	182	11,4	11,4	24,3
	3,00	473	29,6	29,6	53,9
	4,00	339	21,2	21,2	75,1
	5,00	399	24,9	24,9	100,0
	Total	1600	100,0	100,0	

According to Table 4, 473 out of 1600 students (29.6% of the students) answered the item 31 as "undecided". This finding can be interpreted as students need more information about the cost of wind turbines, wind energy and the frequency of use of this energy on Earth.

Table 5. The distribution of the ıtems students have been the most successful

Item no	Items	Points taken from this item	Frequency	Percent
1	I can identify recycling logo (icon)	5,00	1230	76,9
4	Pouring the waste oils to the sink is not harmful.	5,00	1073	67,1
13	I pay attention to closing the taps remained open	5,00	942	58,9
17	I am friendly to plants and animals.	5,00	941	58,8
28	While brushing my teeth the tap remains open till I finish brushing my teeth.	5,00	896	56,0
15	It is better to collect the recyclable waste like glass, plastic bottle, and paper separately.	5,00	890	55,6

19	There is no human influence on global warming.	5,00	865	54,1
6	By reducing the paper consumption, cutting off the tress can be prevented.	5,00	863	53,9

Table 5 gives the numerical values of the eight most successful students by taking "5" points with the highest frequency. When the values are examined, students are knowledgeable about the recycling icon and recycled products, and they have awareness about the importance of recycling.

"I pay attention to closing the taps remained open" and "While brushing my teeth, the tap remains open till I finish brushing my teeth." are two statements that assessing the students' attitude towards saving water resource; previous one is positive the latter is negative.

According to table 5, 941 students out of 1600 that is 58.8% of the students state that they are friendly to plants and animals, additionally, 54.1% of the students are in the opinion that humans have the influence on global warming.

2. Environmental Consciousness by Gender

Table 6: Environmental Consciousness Scales' scores results according to Independent T-Test by Gender

Gender	**N**	$\bar{X}$	**S**	**sd**	**t**	**p**
Female	843	123,28	17,03	1492,37	7,44	,000
Male	757	116,32	20,01			

According to table 6, students" "Environmental Consciousness Scale" scores show significant difference by gender. t(1492,37)= 7,44 ve p< ,05.

When the scores that students have taken from the scale are compared, female students" average score ($\bar{X}$=123,28) is more than male students" average score ($\bar{X}$=116,32). This finding shows that female students have more environmental awareness than male students. The eta-square (η2) value for the unrelated group's T-test was 03. Accordingly, it can be stated that about 3% of the variance observed in the scale scores is sexually related. On the other hand, the calculated Cohen d value is 37. The result shows that the difference between the average scores of male and female students in "Environmental Consciousness Scale" is, 37 standard deviation.

3. Environmental Consciousness by Mother's Educational Status

Table7. Results of variance analysis of environmental consciousness scale scores by mother"s educational status

Mother Educational Status	**N**	**Mean**
1- Non-Literate	57	111,2632
2- Primary School	247	119,0810
3- Secondary School	286	119,0874
4- High School	572	120,1206
5- Undergraduate	385	122,9065
6- Graduate	53	116,0000
Total	1600	119,9938

Source of the Variation	**Sum of Squares**	**sd**	**Mean Square**	**F**	**Significant Difference (p)**
Between Groups	8906,379	5	1781,276	5,091	,000
Within Groups	557751,558	1594	349,907		

Total	566657,938	1599

According to table 7, students" scores which are taken from the "Environmental Consciousness Scale" show a significant difference by mother's educational status. Tamhane test was selected from multiple comparison tests to compare the mean scores of the students by their mothers' education status and to find the source of the difference.

Table 8. Results of tamhane test by mother"s educational status

(I)Mother"s Educational Status	(J) Mother"s Educational Status	Average Score difference (I-J)	Standard Error	Sig.
Illiterate	Primary School	-7,81781	2,84360	,107
	Secondary School	-7,82425	2,86560	,112
	High School	**-8,85747***	2,76189	**,031**
	Under Graduate	**-11,64334***	2,83914	**,002**
	Graduate	-4,73684	4,42944	,994

According to Table 8, Scale scores of the students whose mothers are illiterate are lower than scores of the students whose mothers have high school or undergraduate educational status and the difference between them are found to be significant. (p<0,05). In terms of scale scores, no significant difference is found between students whose mothers are illiterate and other students. (p>0,05).

4. Environmental Consciousness by Father's Educational Status

Table 9. Results of variance analysis of environmental consciousness scale scores by father"s educational status

Father Educational Status		**N**		**Mean**	
1- Illiterate		22		108,0455	
2- Primary School		187		118,6952	
3- Secondary School		280		117,1000	
4- High School		531		119,5273	
5- Undergraduate		498		124,0522	
6- Graduate		82		114,4146	
Total		1600		119,9938	
Source of the variance	**Sum of Squares**	**sd**	**Mean Square**	**F**	**Significant Difference (p)**
Between Groups	16671,258	5	3334,252	9,664	,000
Within Groups	549986,679	1594	S345,036		
Total	566657,938	1599			

According to Table 9, the scores of the students from the scale vary significantly depending on the educational status of their fathers (p <0,05). Results of Tamhane Test, which was used in order to find out in which groups the difference between students" father education status exist, are in below.

Table 10. Tamhane test results by father"s educational status

(I) Father's Educational Status	**(J) Father's Educational Status**	**Average Score Difference (I-J)**	**Standard Error**	**Sig.**
Under graduate	Illiterate	**16,00675***	3,77888	**,005**
	Primary School	**5,35702***	1,48731	**,005**
	Secondary School	**6,95221***	1,41581	**,000**
	High School	**4,52490***	1,15137	**,001**
	Graduate	**9,63757***	2,71212	**,009**

According to Table 10, the scale scores of the students whose parents have undergraduate educational status; are higher than the scale scores of the other students and the difference between them is significant (p <0.05). There is no significant difference between the groups except for the students whose fathers have undergraduate educational status (p> 0,05). This finding can be interpreted as the fact that students whose fathers have undergraduate educational status have more environmental consciousness.

5. Environmental Consciousness by Family Income Level

Table 11. Scale scores‟ variance analysis results by family ıncome level

Family Income per Month		**N**		**Mean**	
Low income		261		117,5211	
Middle income		918		119,7843	
High income		421		121,9834	
Total		1600		119,9938	
Source of the variance	**Sum of Squares**	**sd**	**Mean Square**	**F**	**Significant Difference (p)**
Between Groups	3302,626	2	1651,313	4,681	,009
Within Groups	563355,312	1597	352,758		
Total	566657,937	1599			

According to Table 11, students' scores on the scale change significantly according to the monthly income levels of their families (p <0,05). Results of Tamhane Test, which is used in order to find out in which groups identified significant difference exists, are shown in the table below. (Table 12)

Table 12. Results of tamhane test by family ıncome level

(I) Monthly Family Income	**(J) Monthly Family Income**	**Average Score Difference (I-J)**	**Standard Error**	**Sig.**
Low Income	Middle Income	-2,26324	1,31447	,236
	High Income	**-4,46230***	1,51091	**,010**
High Income	Low Income	**4,46230***	1,51091	**,010**
	Middle Income	2,19906	1,13445	,151

According to Table 12, there was no significant difference in the scale scores of the students whose family monthly income was moderate among the other students (p> 0,05).

In the families with high monthly income level, the scale score of the students; were higher than the families with low monthly income and the difference between them was significant (p <0,05).

6. Environmental Consciousness by Schools

Codes given to Schools

When school codes were given, the schools' success rankings in the April 2016 TEOG exam were taken into account, and coding was made from the most successful school to the most unsuccessful school. According to this, Eren Şahin Eronat, in TEOG Exam had the highest average score among 18 schools participating in the study with an average score of 80.47; this school had been given the code "1". In the April 2016 TEOG Exam, the "18" code was given to the Lion Secondary School, which is the most unsuccessful school with an average score of 43.45.

Table 13. Variance analysis results of the students‟ scale scores by schools

School Code	School Name/ County Name	N	Avarage Score
1	Eren Şahin Eronat Secondary School/ Karşıyaka	106	116,7547
2	Yavuz Selim Secondary School/ Bornova	114	125,6491
3	Nevvar Salih İşgören Secondary School/ Gaziemir	142	122,4577
4	Kaymakam Özgür Azer Kurak Secondary School/ Bayraklı	109	120,2385
5	Güzelyalı Secondary School/ Konak	209	118,6172
6	Asil Nadir Secondary School/ Balçova	33	121,8788
7	Hasan Ali Yücel Secondary School/ Buca	81	114,1111
8	Cemil Midilli Secondary School/ Karabağlar	55	120,7636
9	12 Eylül Secondary School/ Narlıdere	117	118,2393
10	Suphi Koyuncuoglu Secondary School/ Bornova	92	123,5978
11	Başögretmen Atatürk Secondary School/ Balçova	40	122,8500
12	Piyale Secondary School/ Bayraklı	63	118,6349
13	Oguzhan Secondary School/ Narlıdere	44	125,9773
14	Akıncılar Secondary School/ Buca	102	117,2353
15	Kazım Karabekir Secondary School/ Karabaglar	185	123,5297
16	Karşıyaka Yamac Secondary School/ Karşıyaka	26	112,0769
17	Kemal Atatürk Secondary School/ Konak	42	115,4762
18	Aslanlar Secondary School/ Gaziemir	40	109,6500
Total		1600	119,9938

Source of the Variation	Sum of Squares	sd	Average of Squares	F	Significant difference (p)
Intergroup	22404,524	17	1317,913	3,831	,000
Intragroup	544253,414	1582	344,029		
Total	566657,937	1599			

According to the Anova table given in Table 13, there is a significant difference between the scores of the students in the schools (p <0,05). The Tamhane Tests showing the differences between these schools are as follows.

Table 14. Tamhane test results by schools

(I) School code	(J) School code	Average score difference (I-J)	Standard Error	Sig.
2,00	7,00	**11,53801***	3,02752	**,030**
18,00	2,00	**-15,99912***	3,77702	**,011**
	13,00	**-16,32727***	4,26952	**,040**
	15,00	**-13,87973***	3,46764	**,033**

According to table 14, “2” coded Yavuz Sultan Selim Secondary School students‟ scale scores are higher than “7” coded Hasan Ali Yücel Secondary Schools and significant difference between them is found. (p<0,05).

Additionally, "18" coded Aslanlar Secondary School's scale score is lower than "2" coded Yavuz Sultan Selim Secondary School, "13" coded Oguzhan Secondary school and "15" coded Kazım Karabekir Secondary School and significant difference between them is found. ($p<0,05$).

7. Correlation Between Applied Scale and TEOG Exam Success Rankings

Table 15. Correlation between environmental consciousness scale and TEOG success rankings

		CBFO Average Score	TEOG Exam Average Score
CBFO Average Score	**Pearson Correlation**	1	**,492***
	Sig. (2-tailed)		,038
	N	18	18
TEOG Exam Average Score	**Pearson Correlation**	**,492***	1
	Sig. (2-tailed)	,038	
	N	18	18

According to Table 15, there is a moderate, positive and significant relationship between the TEOG Exam averages and the Environmental Consciousness Scale scores of the students in the schools. (Pearson correlation coefficient: $r = 0,492$ and $p < 0,05$). Accordingly, it can be said that as the success of the schools in the TEOG Exam increases, the scores of the students in the Environmental Consciousness Scale (EBFÖ) increase. When the coefficient of determination ($r2 = 0.24$) is taken into consideration, it can be said that 24% of the total variance in the CBFRS scores is due to the success of the TEOG Exam.

Conclusion

The average score of the 1600 students who participated in the study is 119,9938. Taking into consideration that, the range of scores that can be taken from the scale is between 0 and 155, the average success of the students in the scale can be expressed as 77,415 points over 100 points. From this, it can be concluded that most of the students are successful in the applied scale that is the environmental consciousness is close to high.

When the frequency table of the students' answers is examined; if the percentage of answers given to any of the items on the scale is higher than the 15% threshold, we think that the answers given to the item have a significant share in the group. The frequency percentage of the answers given to 23 items on the scale we applied was determined as "undecided" above 15%. This finding suggests that although the students are successful on the scale, the number of topics they are unstable is high.

One of the most undecided topics among students has been biofuels. Students have had difficulty in linking the use of biofuels with prevention of environmental problems. This situation suggests that students do not have enough knowledge about biofuels. "Forest resources do not develop in parallel with paper production in our country" and "I do not find wind turbines and energy production economical because there will not be enough winds in all seasons." Expressions are other issues that students are unstable with high frequency.

Recognizing the recycling icon and recycled products, students have come to realize that recycling is important in terms of conserving natural resources.

According to responses that students have given to expressions "I pay attention to closing the taps remained open." and "While brushing my teeth the tap remains open till I finish brushing my teeth" it is understood that students have a sense of saving the water resources and they try to save water.

81% of the students state that they are friendly to plants and animals.

1303 students out of 1600 that is 81,5% of the students who participated in the study aware ıf-of the fact that it is harmful to pouring the waste oil to sink.

While 68,4% of the students who participated in the study state that human influences on global warming, 15,4% of them remained unstable and 16,2% state that there is no human influence on global warming.

When the scores that students have taken from “Environmental Consciousness Scale” are compared, the fact that female students average score ($\overline{X}$ =123,28), is higher than the average score of male students ($\overline{X}$ =116,32) shows that female students have more environmental consciousness than male students.

When the scores that students have taken from the scale by the educational status of the mothers‟ are examined, it is found that average score of the students whose mothers are illiterate is lower than the students whose mothers have undergraduate educational level.

When the scores that students have taken from the scale by the educational status of the fathers‟ are examined, it is found that there is a significant difference between the scores of the students whose fathers have undergraduate education level and the other students. This difference is in favor of the students whose fathers have undergraduate educational status.

In terms of "Environmental Awareness Scale" scores; a significant difference is found among the students whose families have high monthly incomes and the students whose families have low monthly incomes, this difference is in favor of the students whose families have high-income levels.

The scores that students have taken from the scale vary according to their schools. There is a significant difference in the schools stated below among the 18 schools participated in the study.

i. The average score that Yavuz Sultan Selim Secondary School from Bornova has taken from the scale is higher than the average score of Hasan Ali Yücel Secondary School from Buca.

ii. The average score that Aslanlar Secondary School from Gaziemir ($\overline{X}$=109,6500) is lower than Yavuz Sultan Selim Secondary School ($\overline{X}$=125,6491), from Bornova, Oğuzhan Secondary School from Nazlıdere ($\overline{X}$=125,9773) and Kazım Karabekir Secondary School from Karabağlar ($\overline{X}$=123,5297) „s average scores.

iii. There is not any significant difference is found between other schools.

It is found that there is a moderate positive and significant relationship between the average scores of the schools' TEOG exam scores in April 2016, and the "Environmental Consciousness Scale" (Pearson correlation coefficient: r: 0,492 and p <0,05). According to this result, as the academic success of the students increases, the environmental consciousness level of the students increases.

Discussion

As a result of the study, it is concluded that female students have higher environmental consciousness than male students. Similar comments supporting this result are as follows:

- Gür (2009) In her study with elementary school 8th-grade students, she made a conclusion that female students have more environmental consciousness than male students.
- Varlı (2014) stated that female students 'attitudes towards the environment are higher than the male students' attitudes toward the environment, explaining that this difference is in favor of females in terms of the social role and emotional intensity of the females.
- Derman (2013) stated that girls' awareness of sustainable environment was higher than that of male students.
- Atasoy and Ertürk (2008) observed that female students are more successful than male students in terms of environmental knowledge and environmental attitude.

The study conducted by Teyfur (2008) in İzmir Bornova with 300 students in 4 elementary schools shows that there is no significant difference between the students' attitudes towards the environment in terms of their sex.
In the 15th item on the scale, 80% of students stated that they agree that it is better to collect recyclable waste such as glass, PET bottle, paper separately. However, it is seen that in the 2nd and 21st items which measure the same attainment, students are undecided about putting this idea into practice. 19,9% of the students answered the expression “I throw paper waste into recyclable boxes" and 22,52% of the students answered, "I throw the used batteries with other wastes" as "Undecided". Based on these findings, it has become clear that students have an understanding of recycling and that they have to be more attentive to put this awareness into their lives as a conscious behavior. This finding is consistent with Albaş's (2011) statement that students do not put the information they acquire or possess into the problematic situations they encounter. Additionally this finding shows similarity with the Tanrıverdi‟s statement which suggests that the educational attainments in the elementary school curriculum mostly aimed at gaining information and behavior but not skill awareness value,

and Erten‟s statement (2003) indicating that there is an inconsistency between students' information about the environment and their attitudes towards the environment. In another study, Akbay (2012) concludes that with the "Don‟t Trifle away Your Energy Activities" which is applied to 6,7,8 grade students, students‟ level of environmental information increases but they cannot develop attitudes and behaviors on environmental issues. This conclusion shows that information that students gained about the environment cannot always be used in real life situations and became behaviors.

There is a difference among the results of the study which takes Izmir Province as a sample and determining the environmental consciousness level of the 8^{th} grade students 77 out of 100, Güney‟s (2011) conclusion that in Elementary School System there is not enough environmental consciousness arises among the students, and Atasoy and Ertürk‟s (2008) observation that 6^{th}, 7^{th} 8^{th} graders are not adequate in terms of environmental attitude and environmental knowledge.

It is concluded that students will be able to identify recycling symbol and recyclable products and they are aware of the fact that recycling is crucial in terms of saving natural resources. Additionally, it is stated that students pay attention to saving water resources. This result is supported by findings that Akbay (2012) found that 6th, 7th and 8th-grade students of the primary school have an idea about energy saving behaviors and they know that throwing paper waste into recycling boxes is beneficial to the environment. Similarly, Çimen and Yılmaz (2012) stated that a significant proportion (60%) of the students have knowledge about the concept of recycling, some of their students (33.33%) know recyclable products with samples of these products. Supporting the Varlı‟s (2014) findings which suggest that academically successful students in comparison to academically unsuccessful students have more positive attitudes toward the environment, in this study, it is found that as the TEOG Exam success rankings increase the environmental consciousness of the students increase as well.

The finding stating that students have lack of information about acid rain formation and they have difficulty in constructing the relationship between the fossil fuel consumption and acid rain show similarity with the Demirtaş and Pektaş‟s ideas (2009) stating that students haven‟t adequate information about acid rain.

Seçgin et al. (2010) Despite the fact that there are many correct concepts about environmental issues in students' minds, it is emphasized that the most important problem is that students think of environmental problems independently and they cannot construct the relationship between them, for instance, although air pollution is directly related to forest destruction, global warming, and ozone layer spoil, none of the students managed to explain this relationship, similarly to this findings, It was found that students cannot construct a relationship between:

- environmental pollution and climate change
- fossil fuel usage and acid raid formations
- waste garbage or used oils and energy production
- global warming and human's acts harming the environment
- paper production and forest resources
- bio-fuel usage and environmental problems. The lack of transitions between concepts will prevent the realization of permanent learning. Certain steps should be taken to make students understand the topics and strengthen cause and effect relationship.

Recommendations

Starting with the parents, in schools, and near neighborhood, environmental love should be gained.However, it has been understood that collecting recyclable waste separately is not enough. This may be because students may not be able to find recycling boxes that are actively used in their immediate surroundings. Some steps should be taken that help students turn their information into practice. The number of recycling boxes can be increased, students who collect the most recycled waste can be awarded and students can be encouraged to develop these behaviors.

Students can be provided with information on the cost of installation and benefits of using wind and solar energy from renewable energy sources and making comparisons may be encouraged. Students should be taught that non-ecological energy resources are also not economically viable. Energy production in the countries which are providing all of their energy needs from renewable energy sources, such as Denmark, Sweden and Germany should be explained by exemplifying the relationship with the environment.

It is uncertain that why a student saying "Undecided" in the "Environmental Consciousness Scale" which is prepared by the researcher and have items aiming at environmental attainments existing in 8^{TH} grade 6 unit, and in which negative or positive extremity the student remained undecided. In the results section, the percentages of the items that students are undecided are listed in table 32. The percentages of students' indecision about the items vary between 15% and 30%. Findings can be more clearly interpreted if these students‟ closeness to "agree" and "not agree" edges is known. As the percentage of students who are undecided increases, the uncertainty arising from undecided students will also increase. While the mean score of the group decreases with the negative direction of these students' expressions, the average score of the group may increase in the case of positive expression development. This can affect the result of the study. If the "Environmental Consciousness Scale" is to be used in subsequent studies, it may be suggested to rearrange the grading part of the scale. This is valid for all Likert type scales that include "undecided" or "I'm not sure" choices. Anderson (1981) emphasizes the fact that when the "I'm not sure" option is among the choices, test takers avoid expressing their real answers, therefore it is necessary to use an even number of options. Thus, respondents are compelled to choose to be party or not to be a party towards an attitude object. (Köklü, 1995).

In addition to using even number of options, it can be more effective for students to determine their two-way proximity by themselves, by dividing the distance between the positive and negative options into equal intervals. For example, by dividing "agree" "not agree"options into 10 equal parts, if the students are asked to answer the question by writing a number between 1 and 10 according to the expression status, the students will be able to specify the edge they are close to. (Table 16)

Table16. A rating example that can be recommended on Likert type scales

Item no	Item	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree		Student Response
1	I can identify recycling logo (icon)	1	2	3	4	5	6	7	8	9	10	
2	I put the papers that won‟t be used in the recycling box.	1	2	3	4	5	6	7	8	9	10	

The use of a large number of response options aims to increase the internal consistency of a scale by increasing the number of total response opportunities given to respondents. Increasing the number of response options on Likert scales is similar to increasing the number of items in cognitive tests. The use of fewer options, on the other hand, reflects the belief that it will create a suitable scale for less educated or younger respondents (Köklü, 1995).

By arranging the scale as in Table 16, it is thought that the uncertainty that may occur in the findings is reduced. In this way, even the answers of students who say "undecided" can give an idea about students‟ thinking.It can be interpreted that the students' indecisiveness means that they do not have sufficient knowledge about the subject. It is recommended that by drawing the attention of the students to the issues like Biofuels, usage of fossil resources or solutions to environmental problems, students‟ lack of knowledge can be decreased. For this ambition, Television and the Internet can be used. It is thought that public service adds in the television have an impact on students.

Derman (2013) states that 9^{th} and 12^{th}-grade students gain permanent environmental conscious behaviors mostly from TV, biology lesson, family and internet, and least from other lessons, friends, and scientific magazines. Similarly, Çimen and Yılmaz (2012) found that the internet, which is widely used today, is widely used by elementary school students as well and it is among the sources that students use about recycling. On the same topic, Erman (2013) observed that the "MEDIA (TV, Internet, Newspaper, etc.)" factor increased it impacts on people‟s level of consciousness.

For this reason, short films or public spots can be prepared that briefly introduce bio-fuel vehicles and explaining how it would be beneficial to the environment, increasing its usage. According to the findings of the study, students stated that the pouring of waste oils into the sink is detrimental. By associating biofuels with the recycling of waste oils, in the light of students‟ other information, students can develop solutions and they can develop associations between information thus learning process becomes permanent.

References

Gür, K. (2009). „İlköğretim Sekizinci Sınıf Öğrencilerinin Çevre Bilinci Kazanım Düzeylerinin Belirlenmesi" Balıkesir Üniversitesi Sosyal Bilimler Enstitüsü İlköğretim Anabilim Dalı Yüksek Lisans Tezi, Balıkesir.

Varlı, D. (2014).„İlköğretim 8. Sınıf Öğrencilerinin Çevreye Yönelik Tutumlarının İncelenmesi" Gaziosmanpaşa Üniversitesi Eğitim Bilimleri Enstitüsü Fen Bilgisi Eğitimi Anabilim Dalı Yüksek Lisans Tezi, Tokat.

Derman, İ. (2013). „Farklı Başarı Düzeylerindeki Okullarda 9 Ve 12.Sınıf Öğrencilerinin Ekosisteme İlişkin Öğrenme Düzeyleri Ve Sürdürülebilir Çevre Bilinci İlişkisi" Hacettepe Üniversitesi Sosyal Bilimler Enstitüsü Eğitim Bilimleri Anabilim Dalı Eğitim Programları ve Öğretim Bilim Dalı Yüksek Lisans Tezi, Ankara.

Atasoy, E. ve Ertürk, H. (2008). İlköğretim Öğrencilerinin Çevresel Tutum ve Çevre Bilgisi Üzerine Bir Alan Araştırması, Erzincan Eğitim Fakültesi Dergisi, 10(1), 105-122.

Büyüköztürk, Ş. (2015). Veri Analizi El Kitabı, Pegem Akademi Yayınları, Ankara.

Teyfur, E. (2008). İlköğretim Öğrencilerinin Akademik Başarılarının ve Çevre Kulübü Çalışmalarının Çevreye Yönelik Tutumlarına Olan Etkisi (İzmir Örneği), Ege Eğitim Dergisi (9) 1: 131-149.

Albaş, M. (2011). „İlköğretim Programındaki Çevre Bilinci Kazandırmaya Yönelik Kazanımların İşe Vurukluğu" Anadolu Üniversitesi Eğitim Bilimleri Enstitüsü Yüksek Lisans Tezi, Eskişehir.

Tanrıverdi, B. (2009). Sürdürülebilir Çevre Eğitimi Açısından İlköğretim Programlarının Değerlendirilmesi. Eğitim ve Bilim, 34(151).

Erten, S. (2003). 5. Sınıf Öğrencilerinde "Çöplerin Azaltılması" Bilincinin Kazandırılmasına Yönelik Bir Öğretim Modeli, Hacettepe Üniversitesi Eğitim Fakültesi Dergisi 25: 94-103.

Akbay, Ç. G. (2012). „İlköğretim 6. 7. Ve 8. Sınıf Öğrencilerinde "Enerjini Boşa Harcama Etkinlikleri" İle Çevre Bilincinin Kazandırılması" Hacettepe Üniversitesi Sosyal Bilimler Enstitüsü İlköğretim Anabilim Dalı Yüksek Lisans Tezi, Ankara.

Güney, O. (2011). „Çevrenin Korunmasında Çevre Bilincinin Etkisi: İlköğretim Sistemimiz Üzerine Bir Araştırma" Niğde Üniversitesi Sosyal Bilimler Enstitüsü Kamu Yönetimi Anabilim Dalı Yüksek Lisans Tezi, Niğde.

Çimen, O. ve Yılmaz, M. (2012). İlköğretim Öğrencilerinin Geri Dönüşümle İlgili Bilgileri ve Geri Dönüşüm Davranışları, Uludağ Üniversitesi Eğitim Fakültesi Dergisi 25 (1), 63-74.

Demirbaş, M. ve Pektaş, H. M. (2009). İlköğretim Öğrencilerinin Çevre Sorunu İle İlişkili Temel Kavramları Gerçekleştirme Düzeyleri, Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi (EFMED), 3(2), 195-211.

Seçgin, F., Yalvaç, G. ve Çetin, T. (2010). İlköğretim 8. Sınıf Öğrencilerinin Karikatürler Aracılığıyla Çevre Sorunlarına İlişkin Algıları International Conference on New Trends in Education and Their Implications, Antalya.

Köklü, N. (1995). Tutumların Ölçülmesi ve Likert Tipi Ölçeklerde Kullanılan Seçenekler, Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi, Cilt: 28 Sayı: 2, 81- 93.

Erman, M. A.(2013). „Etkin Çevre Bilincinin Yerleştirilmesinde Aile, Okul Ve Sosyal Yaşam Alanının Etkisi" Yüzüncü Yıl Üniversitesi Eğitim Bilimleri Enstitüsü İlköğretim Anabilim Dalı Yüksek Lisans Tezi, Van.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 344 - 348

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Smart City Companies in Turkey

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Abstract: Smart Cities use Information and Communication Technologies to manage the resources and services offered by a city more effectively and to bring them closer to all stakeholders (citizens, corporations and public administration). Public or private companies implement smart city practices among stakeholders. Smart city practices are expected to accelerate economic growth and social development. However, it is a fact that a country has become fully smart cities but only with domestic and national companies. Technology companies that manufacture smart city in Turkey can be a domestic-national company or a company which is distributor belongs to a foreign company. In this study, national and regional levels, market research and analysis have been performed related to smart cities in Turkey. As a result of this study, company's type and produced technologies are handled. Thus, the current studies will reveal about the companies located in Turkey related to smart cities. It will be beneficial to all stakeholders involved in smart cities.

Keywords: Smart cities, Companies, Market research, Stakeholders

Introduction

Smart City is a city that uses the resources and services offered by a city to manage it more effectively and to improve people's quality of life. In this direction, people must be in the center of smart cities. In smart cities, people should be superior to technology and companies. The realized smart systems must exist in order to increase people's standard of living. These technologies should not limit people and help people.

Data needs to be a smart city, and technology companies need to process it. There are many different technologies available when the data are taken. These different technologies, protocols and subscriptions can be listed as follows. Long-range (5G / 4G / 3G / GPRS / GPRS + GPS / LoRaWAN / LoRa / Sigfox / 868 MHz / 900 MHz) medium-range (ZigBee / 802.15.4 / DigiMesh / WiFi) and short-range (RFID / NFC / Bluetooth 2.1 / Bluetooth Low Energy), Industrial Protocols (RS-232, RS-485, Modbus, CAN Bus, 4-20mA.).

Along with all these wireless technologies, many wired solutions are available. As you can see, the same systems can be realized with many different technologies. The fact that these technologies are in contact with each other is a necessity for smart cities. In this way, the data can be coexistent and accurate, integrated decisions can be taken for forward. Companies need to take this into account when implementing smart systems.

There are many companies that are leaders in their sector in our country. For example, companies such as GSM Operators (Vodafone, Turkcell, Avea), White Goods Markets (Arçelik, Beko, Bosch, Electrolux, LG, Profilo, Samsung, Vestel etc.), known companies (Microsoft, Ericsson, Oracle, Cisco, Huawei, Hitachi, IBM, Intel, etc.) are available to a large number of IT companies. According to the "Global Smart City Market 2016-2020" research conducted by independent research institute TechNavio, the Smart City Market is expected to grow by about 20 percent annually in 2016-2020 and reach 1.5 trillion dollars worldwide by 2020. The above companies are trying to present some systems that they can do in their own field under the smart city category because of the size of the smart city market, although their basic fields are different.

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

Companies

Some of the companies that are located in the smart city market in our country and the products or technologies that they have developed are given below.

Ausis

Ausis (http://www.ausis.com.tr/) only contributes to smart cities within the context of Smart Transportation Systems. The operations and explanations made within the scope of these systems are given below. Vehicle and Resource Tracker: The fleet tracking and management solution helps to reduce operational costs of the fleet with real time tracking of the firm's vehicles and collects information that will save employees' workforce. The solution consists of in-vehicle hardware and software components that monitor key activity parameters of the vehicle and thus control the drive. All information is accessed via a web-based platform. The solution is designed to serve every size fleet, every type of vehicle and transport type. Eco-Driving, Driver Evaluation, Fuel Inspection and Control, Temperature Control, Route and Order Optimization, Monitoring and control points: Speed, Route, Mileage, Fuel consumption, Working hours and conditions, Travel, Expedition history, In-car computer data, Vehicle maintenance information can be followed. Accident / Collision Prevention System: Pedestrian and Bicycle Collision Warning, Accident Warning, Lane Departure Warning, Tracking Distance Warning, Smart Long Beam Control, Speed Limit Indicator and Traffic Sign Recognition information can be followed.

Deloitte

Deloitte (https://www2.deloitte.com/tr/tr.html) refers to one or more of Deloitte Touche Tohmatsu Limited ("DTTL"), which is established in accordance with the UK legislation, the companies in the member company network and the associated legal entities. It is an organization that has extensive work on smart cities. There are many smart systems in the company. These are: Smart Mobility, Smart Safety, Smart Energy, Smart Water, Smart Waste, Smart Buildings, Smart Homes and Living, Smart Health, Smart Education, Smart Finance, Smart Tourism and Leisure, Smart Retail, Smart Logistics, Smart Manufacturing, Smart Construction, Smart Government.

Logiba

Knowing the critical importance of energy use, Logiba (http://www.logiba.com/) develops eco-friendly and innovative products by keeping energy efficiency and cost optimization in mind for all products it designs and produces with the concept of smart cities. The smart city solutions that Logiba offers are:

Smart Lighting Solutions: Logiba ASAS, which makes the lamps in the park and on the streets smart, is compatible with both classic and LED lamps. With motion, traffic and light sensors integrated in Logiba ASAS, bushings, bikes and vehicles in parks and streets are always light. When the traffic intensity is low, when no one is in the park or on the street, the lighting level is reduced and lighting is done when necessary. The faults and lifetimes of the lighting fixtures are recorded.

Smart Waste Tracking Solutions: Garbage levels are tracked precisely and a centralized warning signal is sent when the specified limit is exceeded. In addition, the temperature of the container is monitored and an emergency warning system is activated in case of fire. Central records are evaluated and planned garbage collection routes are established.

Meterology Solutions: Meterology analysis solutions allow you to access meteorological parameters such as weather, temperature, and temperature information locally. You can retrieve it retrospectively, and view it via reports and graphs.

License Plate Recognition Solutions: Plate recognition systems, which can be used to control the vehicle entry and exit in parking lots, shopping malls, hospitals and schools, help to record the entry and exit vehicles. They are the systems that can calculate how many hours are spent inside the car parks and the amount of payment according to the length of stay.

Power Analysis: Nowadays it is very important to control energy consumption. To provide energy consumption control, it is first necessary to analyze the energy. Power analysis solutions monitor and analyze energy consumption in networks and systems and present energy reports of user network and systems.

Proline

Proline (https://www.pro-line.com.tr/tr/SitePages/home.aspx) supports smart cities with Geographic Information Systems Solutions and Smart Security Management System.

Geographic Information Systems Solutions is a map-based management information system that enables users to collect, store and analyze spatial information. With Smart Security Management System, vehicle information can be continuously checked by registering city entrance and exit times, plate number and lane details. In case that the behavior detection alarm is triggered, the image can be reflected on the screen at the same time and can be defined as Crowd violation, Navigation, Zone entry, Missing object, Standing object, Standing vehicle identification. Vehicle tracking system and safety devices can also be monitored simultaneously on the map. All video content is automatically analyzed and changes can be reported simultaneously to the operator. With the appropriate calibration settings, objects can be defined by size / speed characteristics. Using the most advanced technology monitoring solutions and real-time images with Cameras and Monitoring Software; Safety strike violations, Red light violations, Safe track crossing violations, Vehicle use on the reverse side, Instant speed measurements, Average speed detection, Incorrect parking detection and many other violations are detected simultaneously. In addition to instant detections, images of any past time interval can be re-evaluated. This advanced technology is not just traffic rule violations; The suspicious packet is detected instantaneously at various occasions such as the detection of the called party, and it is possible to generate automatic notices by this system.

Turksat

Turksat's (https://www.turksat.com.tr/tr) vision is to regain Turkey's eGovernment and IT strategies with appropriate smart municipal services. The Smart City Components offered by Turksat are:
IOT management platform: IOT management platform can be presented, with interface options designed to suit customer needs.

Smart Environment: Smart Lighting Systems, Smart Irrigation Systems, Waste Management Systems
Smart Life: City Promotion Systems and Information Kiosks, Security Services, City Monitoring Systems, Educational Services, Tourism

Smart Networks and Information Communication Infrastructure: Broadband Infrastructure, Fiberoptic Lines, WiFi Networks, Wireless Network Points, Service Focused Information Systems

Smart Transportation: Smart Interchange and Signaling Systems, Electronic Control Systems (EDS), Traffic Measurement Systems, Variable Traffic Sign Systems (VMS), Pedestrian Protection Systems, Park Orientation Systems, License Plate Recognition and Control Systems, National and International Accessibility, Smart Stop Systems , IT Infrastructure, Sustainable Innovative and Secure Transportation Systems

Health Services: Panic Button, Chronic Patient Tracking Systems, Medical Coaching Service

Turk Telekom

Turk Telekom (http://www.sehirlerakillaniyor.com/) is working to make cities more livable with 214,000 km of fiber infrastructure and 4.5G network. The biggest difference of Turk Telekom Smart Cities from other narrow-scale solutions is to bring 20 different solutions together with full integration and provide citizens with a real smart city experience. From smart traffic to smart irrigation, smart lighting and special convenience for the disabled, the service is offered in many sub-titles. The solutions used for smart cities have been developed by Turk Telekom Group and its solution partners. Even in the solution from abroad so as to make production agreements have been made in Turkey. Business partners of Turk Telekom are Borda, ISSD, Jenoptik, Isbak, Ortem Elektronik, Sesa, Udea, Boni, Verisun and Sade. In order to establish smart cities, Turk Telekom has made a protocol and cooperation with the Karaman Municipality and Karaman Governorship on the subject. On the Karaman Municipality page, no developments or conclusions regarding this cooperation have been seen. Smart city applications and content on the page of Turk Telekom are given below.

Traffic Density information: TEDES instantly captures speed and red light violations. This ensures safe traffic flow and avoids accidents.

Park Camera View: The city becomes safer with the BuluTT eye. The images are stored in Turkey's first Tier 3 certified data center.

BuluTT Eye: With BuluTT Eye your office can be more secure. You can view your office on the web for 24 hours and keep records backwards.

Intersection: By means of the smart intersection, if the number of cars in the intersection is greater than the number of cars in the intersection, the vehicles on that intersection are allowed to pass. Thus, the number of cars waiting at the intersection is shortened.

Parking Fill Rate: The biggest problem of the cities is the parking problem. With smart parking, citizens can see the nearest free parking area via mobile application or web, and there is no need to search the parking area for a long time to park the car. There is no time loss and CO2 emissions are reduced.

Monthly Water Saving Information: Irrigation systems need to be used extensively and efficiently in order to be able to use water effectively, which is the most important natural source of life and future. With smart irrigation, parks, gardens and green spaces in the city; sensors that detect the amount of moisture in the air and the earth are being watered in the right amount at the right time. With the central management system, which is part of the application, all irrigation procedures can be followed; there is a serious water saving throughout the city.

New Age Technologies

New Age Technologies (http://yenicagteknolojileri.com/) have contributed to smart cities through developed sensor nodes and gateway nodes. The company is working in the field of Wireless Sensor Networks and is producing projects in this area. In addition, the company offers Electronic Services, Mobile Solutions and Web Solutions. The applications and contents according to their catalogs are given below.

Home Automation Applications: Smart Home Systems, Building Security Systems.

Commercial Applications: Vehicle Tracking Systems, Person and Object Tracking Systems, Energy Line Monitoring Systems, Lighting Control Systems, Traffic Light Control Systems, Fire Systems.

Health Practices: Systems for determining the location of doctors at the hospital, Systems for monitoring the status of patients, Systems for monitoring the elderly, Systems for monitoring various healthful parameters.

Environmental Applications: Weather Systems, Air Pollution Detection Systems, Flood, Earthquake, Forest Fire Monitoring Systems, Agricultural Activity Monitoring Systems, Animal Farm Monitoring Systems.

Military Applications: Monitoring systems of war zones, Monitoring systems of enemy movements, Discovery systems for land, Monitoring systems of personnel and military vehicles, Monitoring systems of friendly forces, Systems for detecting the speed and positions of targets.

Discussion and Conclusions

As we have seen, the formation of smart cities in Turkey has just begun. Most companies have taken steps in this regard. These companies are engaged in both technological production and realization of their applications. But it should be known that smart cities are a matter of being from transport to environment, from economics to governance, from life to health, from industry to security. Just implementing a small part of a system should not mean that the city is smart. For the technologies implemented by the companies for smart cities, firstly a testing site should be established and the related technologies should be examined from the technical point of view as well as the environment and health. In this way, the final products and processes must be applied in real cities after the testing environment. Otherwise, unexpected bad results may occur. For companies' technology development, they need to use the data of institutions. However, unfortunately, a public institution still cannot share its data with other public institutions. The more data is shared, the faster it will be for city solutions. If inter-agency cooperation is not possible, it is unlikely that the smart applications of cities will be successful. American and European countries are at an advanced level at the point of smart cities. This countries are in the advanced level, because they have a lot of technology companies. However, there is not exactly a smart city available right now. At the point of smart cities in our country, the number of domestic and national companies should be increased. At the point where our country provides smart cities, it is necessary to get support from these domestic and national companies. Because the applications that will be used throughout the country to collect important data must belong to that country at both hardware and software point. This provides both a contribution to full independence of this country and information that can create intelligence is kept within the country.

References

"Ausis", http://www.ausis.com.tr/
"Deloitte", https://www2.deloitte.com/tr/tr.html
"Logiba", http://www.logiba.com/
"Proline", https://www.pro-line.com.tr/tr/SitePages/home.aspx
"Turksat", https://www.turksat.com.tr/tr
"Turk Telekom", http://www.sehirlerakillaniyor.com/
"New Age Technologies", http://yenicagteknolojileri.com/

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 349 - 353

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

E-waste Generation, Awareness and Management in Third World Countries: Prospects and Challenges

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Abstract: The millions of tonnes of e-wastes being annually as a result of development od science and technology since the 20th is, to say the least, a time-bomb waiting for explosion with disastrous consequences, if left unchecked. This paper presents the outcome of a survey in e-waste generation, awareness and management in third world. Countries like Malaysia and Nigeria. The choice of these two countries (one from Africa and the other from Asia) is borne out of their strategic locations and activities in e-wastes generation cum management scale of preference. The paper examines the major present awareness level of e-wastes, individual, corporate and governmental contributions to e-wastes management and control, Using the Anchor University Lagos, Nigeria and the Universiti Malaysia Pahang, Kuantan, Malaysia as its locale, the paper investigates the awareness of e-wastes, hazards posed and efforts required to properly control and manage e-wastes in third world countries

Keywords: Awareness, Control, E-wastes, Management, Third world countries

Introduction

The impact of industrial revolution cum information, communication and telecommunication technology in world development, is to say the least, monumental. Industrial technology (ICT) revolutionized the way things are done in the world leading to enhanced efficiency, effectiveness and massive productivity (Odili, 2013). One can only imagine the sorry state the world would have been without industrial revolution. Emanating from industrial revolution is ICT which has so influenced the world beyond, practically, any other technology. Today, there is virtually no academic, scientific and industrial discipline that has not been affected by ICT. ICT has led to the development of several algorithms such as the Genetic Algorithm (Tohsato, Ikuta, Shionoya, Mazaki, & Ito, 2013), Particle Swarm Optimization (Kunna, Kadir, Jaber, & Odili, 2015), African Buffalo Optimization (Odili & Kahar, 2016; Odili, Kahar, & Anwar, 2015), among several others that has been successfully applied to transportation (Sadeghi, Sadeghi, & Niaki, 2014), electrical and electronics engineering (Liu, Fu, & Yang, 1999), telecommunications (Kershenbaum, 1993), etc to achieve great results that have enhanced human development.

In spite of these great achievements, ICT has just introduced a daunting challenge to the world: electronic wastes (popularly called e-wastes), which if not properly handled, may dwarf the monumental breakthroughs of

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the ICT revolution (Qu, Zhu, Sarkis, Geng, & Zhong, 2013). E-wastes refers to unserviceable cum discarded electronic devices, sometimes reserved for recycling, resale or simply meant for the nearest dumpsite. Sometimes, e-wastes which are sometimes regarded as e-scraps include such electrical or electronic components as Central Processing Units (CPU) Cathode Ray Tube (CRT), cell phones etcetera contain non bio-degradable, human- and environmentally-harmful substances such as beryllium, lead, plastic additives, plastics, acids or cadmium (Kush & Arora, 2013).

The common toxic components in electronics such as computers includes the circuit boards that houses heavy metals such as lead & cadmium, mercury switches, mercury used in flat screens , brominated substances that are on printed circuit boards, connection cables and plastic casings, laptop batteries that contains cadmium; CRTs that contains barium and lead oxide (Yuan, Li, Zhang, & Saito, 2012)etc.

A potent challenge in e-waste management is that resale and recycling do not necessary solve the problem since in electronics engineering since there are frequent upgrades that tend to diminish and degrade the usefulness of the previous versions. As a result, resale do not seem to be viable solutions and recycling on its part may pose grave health challenge to the recycling staff as well as the adjoining communities due to the engineering processes involved in the recycling process. Outright dumping of these discarded hardware leads to materials leakages in incinerators and dumpsites. These challenges necessitates further research efforts, hence this research paper.

The rest of this paper is organized in the following ways: section two presents the research instrument and locale; section three examines the research findings and discusses the results obtained; section four draws conclusion on the study. These are followed by the acknowledgement of support for the study and references

Research Instrument And Locale

This research is carried out with the aid of structured and unstructured questionnaires aimed at obtaining relevant responses from the respondents. The questionnaires were administered to students and staff of Anchor University, Ayobo, Lagos, Nigeria and the Universiti Malaysia Pahang, Kuantan 26300, Malaysia. It must be observed that 47.41% out of the distributed 116 questionnaires were returned. The low returned could be a demonstration of the lack of knowledge of the subject matter of e-waste. Actually, many of the returned questionnaires had the respondents simply write 'I don't have any idea' as the answers in many of the questions. This development is no wise seen as a limitation because it helped the underscore the need for the research work: many enlightened persons are unaware of the dangers posed by e-wastes.

Research Findings and Discussion of Results

To highlight the level of ignorance of e-wastes even among Computer Scientists, I hereby reproduce the responses of five postgraduate students of Computer Science in the Universiti Malaysia Pahang, Kuantan, Malaysia. The seventh question in the questionnaire (See appendix A) reads 'IN YOUR OPINION, WHAT IS AN E-WASTE?' The responses are:
Respondent A: I don't have knowledge enough
Respondent B : Data generated by computers and electronic devices which are not safe
Respondent C: Reuse of electronic devices that are discarded
Respondent D: I don't have any idea
Respondents E: Is the redesign, reuse, resale, salvage, recycling of electronic devices
The above responses underscore the problem of e-waste management when one understands that were the definitions of e-waste from research students of Computer Science in a fast developing country like Malaysia. The need for aggressive public enlightenment and aggressive mass education on e-wastes enlightenment and management cannot be over-emphasized.
In answer to the eighth question where respondents were required to list five common generators of e-wastes, the responses were rather ridiculous. The responses from the same five respondents are:
Respondent A: I don't have any idea about e-wastes
Respondent B: Cameras (digital cameras), browsers, MS office, Download managers, IDEs
Respondent C: India, China, US, Japan
Respondent D: I don't know
Respondent E: Computers, phones, robots, watches, communication towers

From the above responses, it is clear that it was only the fifth respondent that has a faint idea of what can generate e-wastes

Individual Contribution to E-Waste Control

In Question 9 of the questionnaire, respondents were asked to identify contribution of individuals in the e-waste control. The percentage responses are given in Table 1 below:

Table 1. Individual contribution to e-wastes control

Questions	Percentage
Spreading the news about e-waste	43.6
Highlighting the damages about e-wastes to individuals	36.4
Highlighting the dangers posed by e-wastes to the environment	43.6
Encouraging recycling of e-wastes	38.2
Form/join e-waste awareness clubs	18.2

As is evident from Table 1, majority of the respondents believe that the two most important individual contributions to e-waste control should be spreading the news about e-wastes thus creating awareness as well as highlighting the dangers posed by e-wastes (43.6% each). Next to those two efforts is that individuals should encourage recycling of e-wastes (38.2%), closely followed by the need for individuals to highlight the damages caused by e-wastes to individuals (36.4%). It is important to note, however, that majority of the respondents are not convinced that forming or joining E-Wastes Awareness Club is necessary. Only 18.2% of the respondents feel that forming or joining an E-Wastes awareness Club is important.

Aside the responses above, in the unstructured part of the questionnaire, respondents added that individuals should begin to properly dispose their e-wastes, embark on aggressive campaigns against improper e-wastes management as well as work towards the total eradication of e-wastes.

Corporate Bodies Contribution To E-Wastes Control

In answer to another question bothering on the contribution of corporate bodies to e-waste management, the responses are presented in Table 2 below:

Table 2. Corporate contributions to e-waste management

Questions	Percentage
Organize public awareness campaigns	60
Encourage staff to properly dispose their wastes	38.2
Organize competitions among departments in e-waste management	23.6
Give prizes for best e-waste management departments and individual staff	30.9

As can be seen in Table 2, 60% of the respondents believe that the most effective way, corporate bodies can assist in curbing e-waste is by organizing public awareness campaigns to enlighten the public on the dangers posed by e-wastes to the environment. 38.2% of the respondents think that the encouraging staff to properly dispose their e-waste is a good idea. Similarly, 30.9% of the respondents feel that giving out prizes to departments and individuals would rather be the best option. However, another 23.6% of the respondents are rather more comfortable with organizing competitions among departments on e-waste management. A particular respondent felt strongly that corporate sanctions for improper waste disposal will provide better result than the above

Government's Contribution to E-Waste Control & Management

The next potion of the questionnaire investigates the role of the central government in the effort to control and manage e-wastes. The responses are presented in Table 3

Table 3. Individual contribution to e-wastes control

Questions	Percentage
Organize public awareness campaigns	50.9
Encourage citizens to properly dispose their wastes	36.4
Organize competitions among states and local governments in e-waste management	21.8
Give prizes for best e-waste management individuals, corporate bodies and arms of governments	20
Make budgetary provisions for e-waste management	32.7

Statistics from Table 3 indicate that many people advocate the organization of aggressive enlightenment campaign as being vital to solving the problem of e-wastes (50.9%). Next to this is the need to encourage citizens to properly dispose their wastes (36.4%), make budgetary provisions for e-waste management (32.7%), organize competitions among states and local governments in e-waste management (21.8%) and finally giving out prizes for best e-waste management individuals, corporate bodies and arms of governments (20%).

Conclusion

This study examined the awareness, control and management of e-wastes in third world countries. Using Malaysia in the Asian continent and Nigeria in Africa as case studies, the study discovers the low awareness of different class of persons in the subject of e-wastes. It is disheartening to note that several persons in the enlightened circles of the society, (represented by students and staff of two prominent universities in these countries) know very little about e-wastes. Rather more disturbing is the fact that some Lecturers as well as Masters' degree and PhD students still are largely ignorant of the dangers posed by e-wastes.

This study having investigated the contributions of individuals, corporate bodies and governments in the effort to control e-wastes opines that three relevant bodies need to work cooperatively in the effort to control and manage e-wastes. The management and control of e-wastes to be successful in the third world, individuals, corporate bodies and the various arms of government should work together to avert this looming human catastrophe: e-waste. This they can achieve through effective grass root awareness, effective wastes disposal strategies, proper education of the dangers posed by e-wastes, formation of e-waste management clubs and proper reward systems for those who properly dispose of their e-wastes.

It must also be emphasized that while the governments in third world countries should encourage proper recycling and disposal of e-wastes through proper budgetary provisions and regulations, penalties and fines should be imposed on erring individuals and companies in order to prevent the alarming pollution of underground water systems, systemic destruction of our aquatic life as well as environmental pollution resulting from improper e-wastes disposal.

In view of the implosive dangers posed by e-wastes if not properly managed this study concludes that governments of third world countries should in addition to creating a special government agency dedicated solely to aggressive awareness, control and management of e-wastes, e-wastes awareness, control and management should incorporated into tertiary school curriculum

References

Kershenbaum, A. (1993). *Telecommunications network design algorithms*: McGraw-Hill, Inc.

Kunna, M. A., Kadir, T. A. A., Jaber, A. S., & Odili, J. B. (2015). Large-scale kinetic parameter identification of metabolic network model of e. coli using PSO. *Advances in Bioscience and Biotechnology, 6*(02), 120.

Kush, A., & Arora, A. (2013). Proposed Solution of e-Waste Management. *International Journal of Future Computer and Communication, 2*(5), 490.

Liu, S., Fu, L., & Yang, W. (1999). Optimization of an iterative image reconstruction algorithm for electrical capacitance tomography. *Measurement Science and Technology, 10*(7), L37.

Odili, J. B. (2013). Application of ant colony optimization to solving the traveling salesman's problem. *Science Journal of Electrical & Electronic Engineering, 2013*, 175-177.

Odili, J. B., & Kahar, M. N. M. (2016). AFRICAN BUFFALO OPTIMIZATION ico-pdf. *International Journal of Software Engineering and Computer Systems, 2*(1), 28-50.

Odili, J. B., Kahar, M. N. M., & Anwar, S. (2015). African buffalo optimization: a swarm-intelligence technique. *Procedia Computer Science, 76*, 443-448.

Qu, Y., Zhu, Q., Sarkis, J., Geng, Y., & Zhong, Y. (2013). A review of developing an e-wastes collection system in Dalian, China. *Journal of Cleaner Production, 52*, 176-184.

Sadeghi, J., Sadeghi, S., & Niaki, S. T. A. (2014). Optimizing a hybrid vendor-managed inventory and transportation problem with fuzzy demand: an improved particle swarm optimization algorithm. *Information Sciences, 272*, 126-144.

Tohsato, Y., Ikuta, K., Shionoya, A., Mazaki, Y., & Ito, M. (2013). Parameter optimization and sensitivity analysis for large kinetic models using a real-coded genetic algorithm. *Gene, 518*(1), 84-90.

Yuan, W., Li, J., Zhang, Q., & Saito, F. (2012). Innovated application of mechanical activation to separate lead from scrap cathode ray tube funnel glass. *Environmental science & technology, 46*(7), 4109-4114.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 354-358

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Teaching Computer Science in the Universities in Third World Countries: Challenges

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Abstract: That Computer Science is fast becoming the moderating disciples in modern education worldwide is not an overstatement. There is virtually no academic or professional discipline that computer science has not influenced in the last three decades. This paper presents the challenges of teaching Computer Science in tertiary institutions in a third world country. Using the Anchor University Lagos as its locale, the paper investigates the challenges being faced by students and teachers, alike, in the teaching of Computer Science. After a comprehensive survey of different cadre of staff and students, the paper asserts that under-funding, insufficient teacher-training facilities, lack of basic educational technology facilities remains some of the primary barriers to effective and efficient teaching cum learning of Computer Science in many developing countries. To address this situations a number of cost-effective recommendations were made to address this problem. Some of which are the need for adequate budgetary provisions to the teaching and learning of computer Science, need for adequate teacher motivation, improvisation of needed facilities and industry cum improved teacher-training syllabus.

Keywords: Teaching, Computer science, Universities, Challenges etc

Introduction

Among the several developments of the 20^{th} century, arguably, Computer Science stands out, especially with the invention of the internet technology. Computer Science has evolved to be a component part of virtually every discipline ranging from medicine (Folkman, 2013), pharmacy (McCoy et al., 2012), administration, education, engineering (J. B. Odili, 2013) to transportation (Odili & Kahar, 2016). Computer Science has helped to enhance these disciplines: making them more accessible to the generality of users and practitioners, enhancing their quality, their communication and use etc.(Odili, Kahar, & Anwar, 2015)

In the light of the benefits of Computer Science to human growth and development all over the world, research efforts aimed at enhancing the teaching and learning of computer science should, therefore, be a step in the right direction. The teaching of Computer Science in Nigerian school system was introduced in 1987 by the then Minister for Education Prof Jibril Aminu during the 32nd ministerial council meeting of the National Council on Education (Yusuf, 2005). This initiative was given impetus by the formation of the National Committee on Computer Education in the same year by the Federal Government of Nigeria (Council, 1996). The National

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Committee on Computer Education.aims at formulation of a dynamic policy on computer education as well as the mass mobilization for computer literacy among Nigeria, Furthermore, the National Committee on Computer Education was empowered to devise clear-cut strategies, terminologies and policy direction for the Federal and State Governments in introducing computer education (Council, 1996).

As a follow up on the initaitaive of the then Minister of Education, when drawing up the National Policy on Education in 2004, computer education was given a pride of place as a technical cum vocational education that leads to the acquisition of practical and applied skills. The relevant portionsof the Nigerian National Policy on Science and Technology aims at developing mass awareness to embrace all aspects of science and technology through: The objectives of science and technology documentwas to realize the national objective

(a) Increased public awareness in science and technology.

(b) The direction of the national science and technology efforts along nationally- defined goals such as self-reliance.

(c) The promotion the outcome of science and technology individual and group efforts into practical goods and services.

(d) The increase and maintenance of indigenous science-based research and development.

(e) The motivation and creation of tangible output in science and technology as a formidable basis for national development (Yusuf, 2005).

From the foregoing discussion, it is obvious that the teaching cum learning of computer science in Nigeria has spanned over three decades. It is, therefore pertinent to examine the present state of affairs in this direction after over thirty years of governmental investment, encouargement support, hence this study

The rest of this paper is organized in the following ways: section two presents the research instrument and locale; section three examines the research findings and discusses the results obtained; section four draws conclusion on the study. These are followed by the acknowledgement of support for the study and references

Research Instrument And Locale

This research is carried out with the aid of structured and unstructured questionnaires aimed at obtaining relevant responses from the respondents. The questionnaires were administered to students and staff of Anchor University, Ayobo, Lagos, Nigeria. It must be observed that 50% out of the distributed 100 questionnaires were returned. The low returned could be a demonstration of the lack of knowledge of the subject matter or mere carelessness. It is also possible that failure to return some of the questionnaires may be due to the fact that due to the tight schedules of some computer science lecturers arising from serious shortage of staff in the field, the respondents did not complete the questionnaires,

Research Findings and Discussion of Results

In view of the enormous contributions of Computer Scıence to human development, this study with the aim of enhancing opportunities in the teaching and learning of Computer Science in tertiary institutions investigated the challenges being faced in teaching of Computer Science. Statistics from the respondents are presented in Table 1:

Table 1. Challenges in learning computer science

Questions	Percentage
Inadequate Teachıng Staff	12
Inadequate Facılıtıes	36
Obsolete Textbooks	10
Irregular Internet Availability	42
Bleak Job Prospect	06
Market Saturation	06
Defient Computer Curriculum	08
Low Morale	14
İnsufficient Teacher-Training Facilities	18

As this table reveals, majority of the respondents (42%) place the irregular internet availability as the primary issue as far as the teaching and learning of Computer Science is concerned. In Anchor University, Lagos, for instance internet availability to students, including the students of Computer Science has recently been increased from three to five hours per student, per day. In as much as this gesture from the University authority is commendable, the staff and students respondents of the University still believe that more needs to be done. The situation may be worse in some remotely-located Universities in many third-world counties around the world,

Similarly, the next major issue to be addressed if the teaching of Computer Science in the Universities in third world countries is to be enhanced, according to 36% of the respondents, is the provision of computer facilities to students. In some developed countries, such as Finland, all undergraduate ICT students are provided with laptops as soon as they register in Universities. This enables the students from indigent backgrounds to have access to their own laptops anytime of the day. Such a gesture goes a long way towards computer proficiency since the students can use their computer systems in the needed practice needed to enhance learning.

Furthermore,18% of the respondents believe that the teacher- training facilities in the University system is inadequate. A situation where University Lecturers are not provided with at least a desktop computer in their various offices leaves much to be desired, especially when one considers the meagre pay of Lecturers in most third world countries. The monthly salary of a fresh PhD Lecturer in Computer Science may not be sufficient to purchase a new laptop. In such a situation, the Lecturer is forced to frequently visit the University Computer Laboratory which may not contain the relevant software in order to make use of computers for his classwork preparation and personal development. The output from such a Lecturer, no doubt, will be suspect.

Also, 14% of the respondents argue that low morale is a major issue in the teaching and learning of computer science. The reason for the low morale is not far-fetched. A situation where students are grappling with ever-increasing tuition and other fees in the University system coupled with inadequate staffing and sparsely-equipped laboratories, teaching and learning cannot be exciting. As such low morale replaces the enthusiasm needed for excellence.

Not to be ignored is the issue of obsolete textbooks that adorn many computer science sections of many University Libraries raised by 10% of the respondents. One wonders the need of physical textbooks these days of e-books and journals. Not only are these books obsolete, it is no more environmentally-friendly to be churning out printed textbooks in modern times in view of the enormous environmental hazards caused by industrial revolution.

Finally, 6% of the respondents believe that job prospect for future computer scientists is bleak and that the computer science job market is saturated. While these respondents are entitled to their opinions, the authors do not share this view. However, in view of the earlier outcome of this research investigation, one can sympathize with the opinion of these respondents. The culmination of the earlier issues results in poor learning environment cum learning outcome which produces poor quality graduates which may not be unemployable. The judgement of these 6% therefore underscores the need for this research enterprise. Technology holds the future of the world's development and this technology revolves around the computer revolution. If the teaching of computer science is not given its due attention then bleak may the future of technology and job creation, the world over.

Conclusions and Recommendations

From the ongoing discussions, it is obvious that more needs to be done in order to sustain the gains the world have derived from the use of computers is to be sustained and improved upon. In the light of this, this study recommends that more computer resource persons should be recruited, not only as computer science lecturers but also as computer laboratory technicians. This way, students will have better access to experts both in the theoretical and practical sessions both in the laboratories and lecture theatres.

Moreover, more teaching aids are needed in universities all over the third world countries so as to make the teaching of computers easier and enhance better understanding. The more real-to-life the teaching and learning of computer becomes, the easier it will become for skill transfer from the experts to the learners. Closely related to this is the need to create more laboratory sessions in the teaching of computer science than what we have presently in virtually all third world countries.

To solve the problem of unemployment, it is recommended that careful industry-academia collaboration is required in curricula development for computer science teaching and learning. There is no need spending so much time in loading the learners with complex computer science theories that have little or no relevance in the computer industries.

Besides, the need for adequate remuneration and other incentives for Computer Science lecturers cannot be over-emphasized. A well-motivated teacher is an indispensable asset to any educational system. Also, the need for teacher-training and retraining is a requirement for greater computer revolution only being dreamt about now. Staff training and development have been found to be invaluable to enhance productivity (J. Odili, 2013).

Further, students should be given a one-to-one sessions both in the laboratories and lecture theatres. Not all learners learn at the same pace, hence the need for this approach. This way, students are trained to be self-reliant job creators rather than job-seekers.

Finally, there is the urgent need for regular internet supply to all staff and students and staff of computer science in order to build up their capacity. Practice, they say, makes for perfection. A situation where internet access is rationed on hourly-basis among staff and students cannot enhance productivity. Everything valuable costs time and money. The need for adequate investment in internet provision cum teaching of computer science is hereby advocated.

Acknowledgement

The authors are grateful to the Department of Mathematical Sciences, Faculty of Natural and Applied Sciences, Anchor University, Lagos for their support. Our gratitude also to the Faculty of Computer Systems and Software Engineering, Universiti Malaysia Pahang, Kuantan 26300, Malaysia and the Universiti Tun Hussein Onn, Johor, Malaysia for additional support

References

Council, N. R. (1996). *National science education standards*: National Academies Press.

Folkman, S. (2013). Stress: appraisal and coping *Encyclopedia of behavioral medicine* (pp. 1913-1915): Springer.

McCoy, D., Pitsillidis, A., Jordan, G., Weaver, N., Kreibich, C., Krebs, B., . . . Levchenko, K. (2012). *Pharmaleaks: Understanding the business of online pharmaceutical affiliate programs.* Paper presented at the Proceedings of the 21st USENIX conference on Security symposium.

Odili, J. (2013). Staff development programs and job performance: Implications for productivity in Lagos state ministry of education. *Journal of Business Administration and Management Sciences Research, 2*(12), 330-334.

Odili, J. B. (2013). Application of ant colony optimization to solving the traveling salesman's problem. *Science Journal of Electrical & Electronic Engineering, 2013*, 175-177.

Odili, J. B., & Kahar, M. N. M. (2016). Solving the Traveling Salesman's Problem Using the African Buffalo Optimization. *Computational Intelligence and Neuroscience, 2016*(2916), 1-12.

Odili, J. B., Kahar, M. N. M., & Anwar, S. (2015). African buffalo optimization: a swarm-intelligence technique. *Procedia Computer Science, 76*, 443-448.

Yusuf, M. O. (2005). Information and Communication Technology and Education: Analysing the Nigerian National Policy for Information Technology. *International education journal, 6*(3), 316-321.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 359-367

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Examination of Effect of Gender on Occupational Accident

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Abstract: Competition among companies is increasing with the development of the technology and changing market conditions. Companies in this competitive environment need to reduce their costs (direct and indirect cost) and increase their productivity. Companies that want to reduce their costs should also give priority to occupational health and safety. So that in Turkey, legislation studies and programs about occupational health and safety are tried to gain the awareness of occupational helath and safety. Determining whether these studies are successful is only possible with statistical analyzes using past years' data. In Turkey, datas of work accident and occupational disease are published by Social Security Instution (SSI). In recent years, it has been seen that female employees take part in many sectors. In this study, in order to determine the effects of gender of occupational accidents, statistical analyzes were carried out in the sectors of "Electrical Equipment Manufacture" and "Manufacture of Textile Products" which female employees are more and most of the occupational accidents are experienced. After the analyzes, the relationship between the gender and living occupational accidents was determined and interpreted.

Keywords: Occupational health and safety, Occupational accident, Estimation

Introduction

The rapid progress of technology and changing market conditions from day to day cause firms to compete. These companies want to increase the production efficency and reduce their costs. In this case, employers do not give importance to occupational helath and safety because they think that it has increased the cost. However, when one of their employees is exposed to a job accident, employees will be exposed to much more Money than they would have to pay to prevent a job accident. Besides the physical burden of job accident, the spiritual burden is also very heavy. Therefore, it is much cheaper and more humane to prevent a job accident. In our country, proactive approach to occupational helath and safety has began to emphasized in recent years. Number of 6331 The Law of Occupational Health and Safety, which was enacted in 2012, aimed to gain the awereness of occupational health and safety to all employers. The obligations (for example job security specialist, workplace phsician, risk assesment etc.) imposed by this law have allowed employers to start paying attention to occupational health and safety. However, our country, Turkey, still ranks ranks first among European countries the terms of number of work accidents.

Occupational accident statistics in European countries Show that occupational accidents can be avoided with measures taken on occupational helth and safety. These measures will reduce both the number of occupational accidents and the employees will work in a safer and more peaceful workplace. This will ensure that productivity of employees is increased and costs are reduced.

In our country, planning of inspections for occupational helth and safety and development of policies according to the the results of work accident statistics is being carried out by the Ministry of Labor and Social Security. In recent years, women workers who are confronted in the most dangerous sectors are being affected by the job accidents. Therefore, issues such as what measures should be taken and what properties shold be developed for women employees sholud be determined.

The statistics of occupational accidents and occupational diseases are published annually by the Social Security Institution in our country. Since the most-up-to-date data during this study was for the year of 2016, so we used statistics of between the year 2001 to 2016 for this study.

In the research conducted, the methods used in previous studies have been investigated. These methods are generally divided into statistical estimation methods and heuristic methods. In past studies, the development of prediction models has benefited from fuzzy logic and artificial neural networks from intutitive methods. However, in past studies, statist,cal methods have been used in the development of most prediction models.

In recent years, female workers in many sectors have come up with antagonism. In many sectors whre male employees are the majority, the number of female employees are increasing. It is also wondered how women workers who face antogonism in many sectors are affeted from the work accidents and how much they are exposed to work accidents ın this study, the effect of gender on living work accidents was examined. Firstly, the sectors, in our country, in which the most occupational accident occured were determined, and it was determined in which sectors the female employees occupied the most in these sectors. Teherefore, statistical studies have been carried out for the effects of gender in occupational accidents in the sectors of “Electrical Equipment Manufacture” and “Textile Product Manufacture” sectors where the number of female workers are also dominant. Later estimating studies were carried out on the number of occupational accident experienced by the women. In calculations made using various estimation methods, estimation error methods were used to determine which method gave the cloesest results. In past studies, th Mean Absolute Persentage Error (MAPE) method has been used more often for determining the best estimation method. Therefore, in this study MAPE mthod is used for comparison of estimation methods.

Literature Review

Occupational safety has become a hot topic all over the World in recent years. It is necessary to use of past statistics to measure the succes of the measures taken to prevent the occupational accidents. Scientists using these statistics have studied to estimate the total number of occupational accidents during the year. It can be determined how succesful the measures taken and the tendency of the number of occupational accidents to be affected, with the help of these studies. The study of Takala (1999), benefited from the ILO fatal accident statistics, including traffic accidents that occured in the number of accidents that resulted in death reported to ILO. In order to reduce the forecast error, they improved the forecast by adding a certain percentage to account for unreported occupational accidents. In another study conducted by Driscol et al. (2005), the differences between the estimates of occupational accidents made up to now and the actual occupational accidents have been examined globally regarding the health and safety of work. In another study conducted by Driscol et al.(2005), they predicted by employing forensic medicine and risk approach data by developing a prediction model related to the number of occupaitonal accident injuries and the number of deaths resulting from occupational diseases. Hamalian et al. (2006) developed a statistical formulation by using the numbers of deaths, fatal accidents and the total population working in that country and insured employees for each group, by dividing the countries into groups according to similar characteristics. They predicted for years to come with using this formulation. In a study conducted by Atwood et al.(2006), they developed a model for offshore oil and gas industry that can estimate the frequency of occupational accidents and costs which are related to occupational accidents. Hamalian and colleagues (2009) conducted a study on the global trend of occupational accidents and occpational disesases resulting in death.

Scientists have also worked in this issue in recent years in Turkey. In a study conducted by Ceylan and Avan (2012), they estimated the number of occupational accidents by 2025 using artificial eural networks method.

Examination of Data

The statistics of occupational accidents and occupational diseases in Turkey are published anually by Social Security Instutitions (SSI) in the Statistical Yearbooks. The data between 2001-2016 were available on the SSI website. Figure 1 has been drwn up from the total number of occupational accidents per year in Turkey. When this figure is examined, it is seen that the number of job accidents is generally around 70000, but in recent years there has been an increase in the number of employees as well as an increase tendency in occupational accidents.

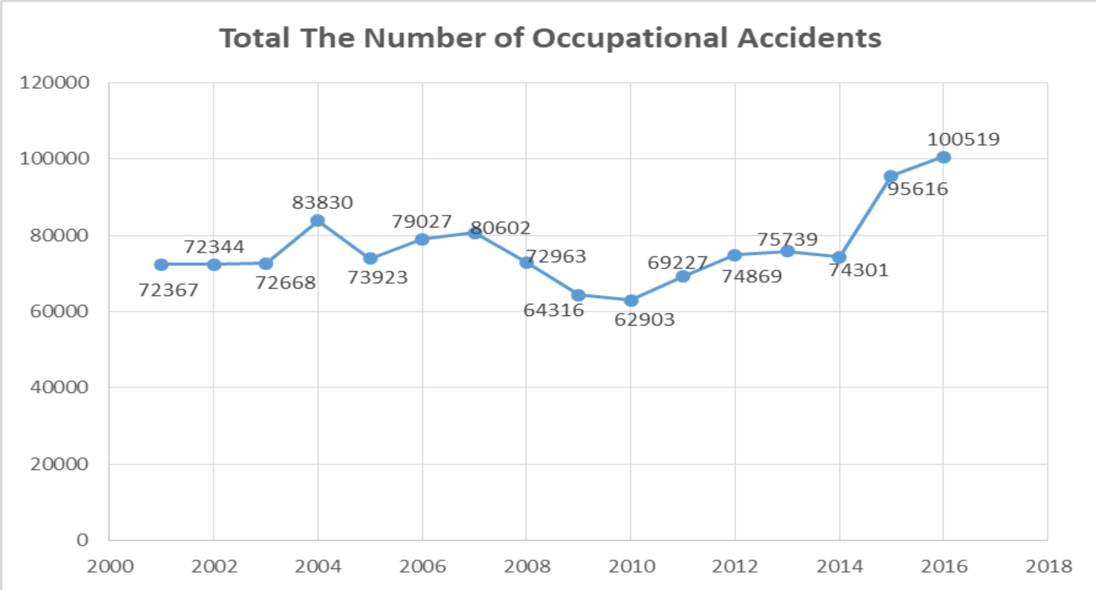

Figure 1. The total number of occupational accidents for years

Figure 2 shows the distribution of occupational accidents by sectors in 2016. According to this figüre, while 9.2% of the occupational accidents in 2016 are "Fabricated Metal Products Production (Excluding Machinary Equipment)", 6.4% are in "Basic Metal Industry" sectors and about 68% are in other 94 sectors it is creating occupational accidents. As seen in Figure 2, most occupational accidents among experienced sectors in Turkey, "Fabricated Metal Products Production", "Basic Metal Industry", "Textile Product Manufacture", "Building Construction" and "Coal – Lignite Removing Sector".

In this study, it is desired to measure the effect of gender on occupational accidents. Therefore, the sectors in which the most occupational accidents occured are the sectors in which the female employees are also located. It has been determined that the female workers of the "Textile Product Manufacture" and "Electrical Equipment Products Manufacturing" sectors mostly occupy the sectors where the job accident is most experienced by using the past datas.

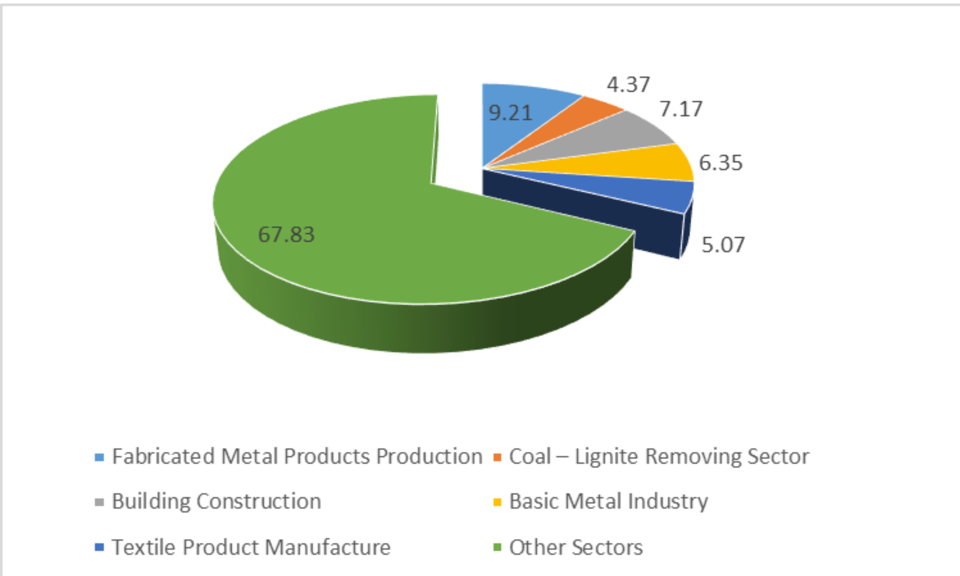

Figure 2. Rate of occupational accidents according to sectors

Figure 3 was created by using the data in Electrical Equipment Products Manufacturing sector. When the figure examined, it is seen that the number of both male and female employees has increased in recent years. Moreover, in recent years, it is seen that the number of female employees are about 1/3 of the number of male employees.

Figure 3. Number of employees in electrical equipment products manufacturing

Figure 4 shows that the number of occupational accidents in the Electrical Equipment Products Manufacturing sector. When the figure is examined, it is seen that the fluctiations in accident numbers are experienced, but they have increased in recent years. It is also seen that women are living with occupational accidents are compared with the number of occupational accidents taht men have experienced, the ratio is even under 1/4.

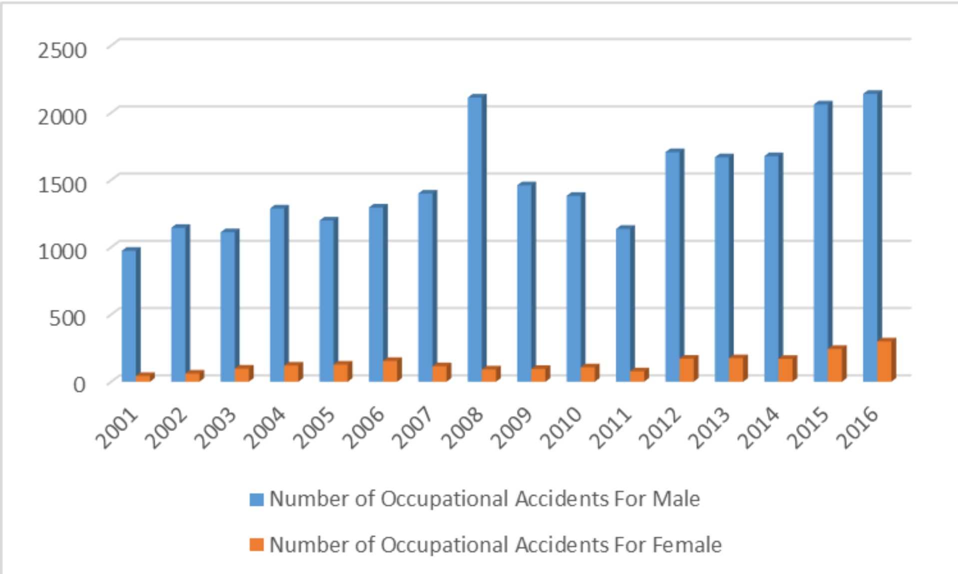

Figure 4. Number of occupational accidents in electrical equipment products manufacturing

One of the sectors where the occupational accident is most experienced is the “Textile Products Manufacturing” sector. Figure 5 shows the distribution of the number of men and women working in Textile Products Manufacturin sector by years. When the figure is examined, it can be seen that the number of male employees in the number of female employees is close to half in some years and in some years it is lower than.

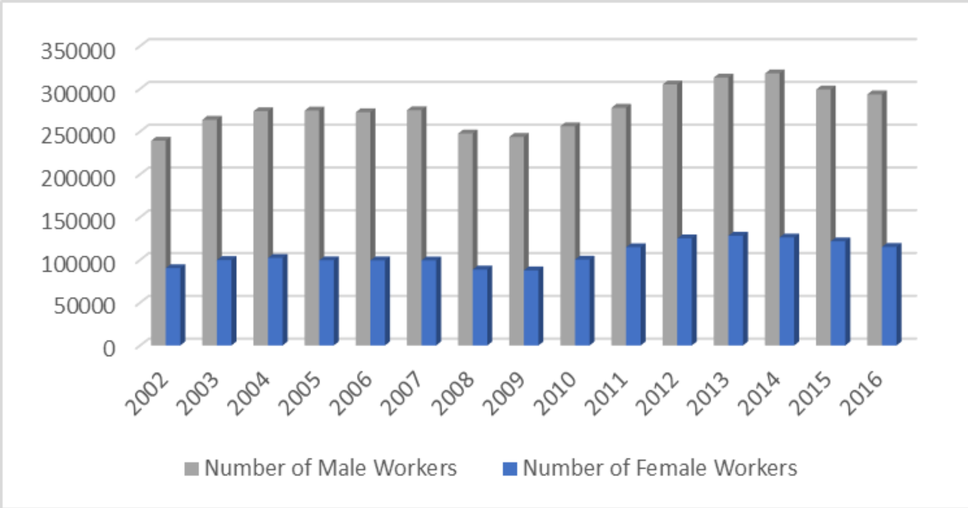

Figure 5. Number of employees in textile products manufacturing sector

Figure 6 shows the distribution of the occupational accidents by the Textile Products Manufacturing Sector according to their genders. When the Figure is examined, it is seen that the number of occupational accidents living in recent years have decreased. The graph shows that male workers have experienced about 3 times more occupational accidents in some years than female workers.

In our previous study, a prediction model was developed for the number of occupational accidents for the 5 sectors which the occupational accident was most experienced. Estimated sectors are especially dangerous sectors (mine, base metal etc.), female workers in these sectors are not generally found. Therefore, in this study, the sectors in which women experience the most ocupational accidents have been identified in order to be able to analyze the effects of women's occupational accidents. It has been thought that prediction models should be developed in order for women workers to predict their future job vacacies for years to come.

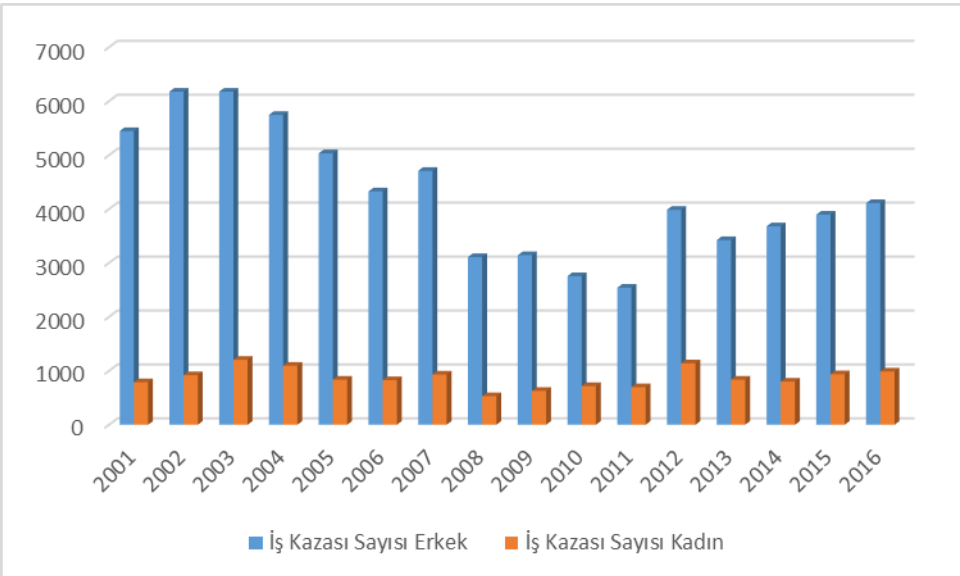

Figure 6. Numbers of occupational accidents in textile production sector by gender

Practice

In the majority of the Occupational Accident Prediction Models made, statistical prediction models were used from previous studies. Mean Absolute Percentage Error (MAPE) method was used for the comparision of prediction errorsin this study because MAPE methos was preferred in the evaluation of prediction errrors in similar studies in the past.

Analyzes For Electrical Equipment Products Manufacturing Sector

In this part of the study, a statistical estimation model was developed for the group of Electrical Equipment Products Manufacturing by making use of the number of work accidents that female workers are exposed to. These methods have been tried to calculete and it has been attemted to determine which method has the best results with the methods of prediction error. When the data for the past years are examined, it is ssen that female workers have suffered from about 150-200 occupational accident each year in recent years.

The calculations for the moving average method, 3 different values for m were calculated. As a result of comparison, it is ssen that estimates made by tking m=4 find the best MAPE value. In the Weighted Moving Average Technique, ten different weight grops were calculated. As a result of comparison, we tried to determine the weight group giving the best predict. The MAPE value was calculated as 24.4% in the calculation with m_1= 1, m_2= 2 and m3=5 weights and the best result was obtained when compared with the calculations made with other weights. The calculations for the Simple Exponential Smoothing Method, it is determined that the best prediction was found for the value of $\alpha = 1,00$. As a result of the calculations made in SPSS with Holt's Dual Parameter Exponential Correction Estimation Technique, the correction coefficents were found as $\alpha = 0.962$ and $\beta = 0.007$ and estimations were calculated using these values. When Brown's Exponential Correction Estimation Technique yielded $\alpha = 0.581$ as a result of calculations made in SPSS, the best prediction results were obtained. In the regression technique, which is one of the statistical methods widely used in estimations, 2001-2012 datas are used. Estimation of the regression equation was made by using these datas and data for years 2013-2016 were used to calculate estimation errors. The equation created by simple regression analysis made with the years 2001-2012 is as follow. In this equation, x is used for the years.

$$\hat{Y} = 73{,}864 - 4{,}752x$$

It is thougt that the number of occupational accidents increase if number of workers increases in a sector. Therefore, while the multiple regression equaiton is being constructed, the number of employees as well as the number of years are used as input daat, and the prediction model for the coming years is created with this data. In this equation x_1 is used for years and x_2 is used for number of workers. The regression equation created using past years' data is as follows:

$$\hat{Y} = -12{,}2 + 5{,}414x_1 + 0{,}005x_2$$

For the years 2013-2016 the MAPE value was calculated as 13.6% in the result of comparison made.

As a result of calculations made by statistical estimation methods, estimation error methods were used to determine which method performed better. We used the MAPE method for the comparison. Table 1 has been generated with the results of estimation error calculated according to the methods used.

Table 1. Estimation errors for electrical equipment manufacturing products sector

Applied Estimation Methods	MAD	MSE	MAPE
Simple Moving Average Method	44,5	2676	29,00%
Weighted Moving Average Method	37,2	2035	24,4%
Simple Exponential Correction Technique	30	1574	29,13%
Holt's Two Parameter Exponential Estimation Technique	27,5	1321	19,85%
Brown's Exponential Correction Technique	28,3	1440	20,84%
Simple Regression Method	216,8	50 305	96,95%
Multiple Regression Method	34	1955	**13,6%**

When Table 1 is examined, it is found that about 20% of the prediction errors are compared with the MAPE method and the best prediction error is found in the Multiple Regression Method.

Analyzes For Textile Products Manufacturing Sector

Statistical estimation methods were used in order to estimate the accident in the textile products manufacturing sector.

With Simple Moving Average Method, estimations were made within three m values. The MAPE method, which is more frequently used than the other methods, is preferred for comparison. When m=3 was taken, MAPE was found to be 17.91% and it was found that if gave the best result according to other m values. In the calculations for the Weighted Moving Average Method, we calculated ten different weights for m values and compared them to each other. The calculations for the Simple Exponential Smoothing Method, it is determined that the best prediction was found for the value of $\alpha = 0.075$. . As a result of the calculations for Holt's Dual Parameter Exponential Correction Estimation Technique, the correction coefficents were found as $\alpha = 0.099$ and $\beta = 0$ and estimations were calculated using these values. When Brown's Estimation Technique was applied, it was determined that the best prediction results were reached wih $\alpha = 0.39$.

While applying Regression Estimation Techniques, regression equations were created by using the numbers of occupational accidents between 2001 and 2012 as input data. The regression equations were used to estimate between 2013 to 2016 and the estimated number of occupational ccidents were compared. The equation created by simple regression analysis made with the years 2001-2012 is as follow. In this equation, x is used for the years.

$$\hat{Y} = 966{,}152 - 16{,}414x$$

In this equation x_1 is used for years and x_2 is used for number of workers. The regression equation created using past years' data is as follows:

$$\hat{Y} = -598{,}568 - 55{,}544x_1 + 0{,}012x_2$$

In the equation, the number of occupational accidents were calculated fort he years between 2013-2016. Comparisons between the values found and the number of occupational accidents were made by prediction error methods.

After applying these estimation methods, MAD, MSE and MAPE values are calculated for each method. Table 2 below compares the methods calculations. In letrature, MAPE, which is the most benchmarking criterion, is compared with the estimation methods. Textile Products Manufacturing Sector Estimation errors were calculated as a result of calculations made for estimating the number of occupational accidents in the sector. When Table 2 is examined, it is determined that prediction errors are about 17% and the lowest prediction error is in Simple Exponential Correction Technique.

Table 2. Estimation errors calculated for textile manufacturing products sector

Applied Estimation Methods	MAD	MSE	MAPE
Simple Moving Average Method	142,9	37 773	17,91%
Weighted Moving Average Method	140,8	36 382	17,69%
Simple Exponential Correction Technique	151,3	35 234	**16,97%**
Holt's Two Parameter Exponential Estimation Technique	147,2	34 895	18,41%
Brown's Exponential Correction Technique	148,7	34 403	18,25%
Simple Regression Method	162	34 607	17,46%
Multiple Regression Method	206,5	56 420	22,4%

Estimation of the Number of Occupational Accidents for the Electrical Equipment Manufacturing Products Sector and Textile Manufacturing Products Sector

In this section, the estimation method fort he number of occupational accidents by female workers and the estimation model fort he future years are calculated by using the estimation model which has the best MAPE value. In the analyzes made, 13.6% MAPE value as the best prediction error resul were found with Multiple Regression Analysis method for Electrical Equipment Products Manufacturing Sector. Thus, fort he period between 2017-2021, the number of occupational accidents for female workers were estimated by using the multiple regression analysis equation. Table 3 shows the estimation results calculated by the equation of multiple regression analysis.

Table 3. Estimation for electrical equipment products manufacturing sector

Years	Estimation of Number of Occupational Accidents
2017	234
2018	247
2019	260
2020	274
2021	289

When Table 3 is examined, it is expected that female workers will experience abaout 250 occupational accidents in the future years. When we examine the number of occupational accidents, we see that it tends to increase at a slight rate.

The lowest MAPE value is calculated for Simple Exponential Correction Method, according to forecast errors calculated for Textile Products Manufacturing Sector. We estimate the number of occupational accidents for 2017 using the value of $\alpha = 0.075$. since the Simple Exponential Correction Method is being used, estimates cannot be calculated for later periods because the data from the previous year are used. Therefore we could calculate only 2017 estimation. Using the formulation, the number of occupational accidents to be experienced in the bTextile Products Manufacturing Sector in 2017 was calculated as 877. The number of occupational accidents does not have a certain trend because there are flactuations in the number of occupational accidents that female workers are exposed to in the Textile Products Manufacturing Sector.

Conclusion

In recent years, as competiton between firms has increased steadily, companies are trying to reduce their costs in order to be able to take part in the sector. Employers avoid investing in occupational health and safety because they see unnecessary costs for occupational health an safety. However, the understanding of taking measures before a occupational accident is happening is both cheaper and more humanistic. Occupational Health and Safety is based on a preventive approach aimed at avoiding the accidents that wil be experienced before the danger occurs.

Occupational Health and safety has become a hot topic in Turkey as it is in many countries in recent years. Especially with the number of 6331 Law of Occupational Health and Safety which was published on June 30, 2012, aweraness about Occupational Health and Safet began to increase. The aim of this study is to investigate whether the measures taken by analyzing with statistical methods in sectors where occupational accidents are very experienced and female workers are concentrated are succesful in decreasing the number of accidents.

In this study, the effect of gender on the living occupational accident was examined. Sectors in which both most of female workers found and suffered from occupational accidents were also identified. As a result of the analyzes, it was determined that the sectors where the most occupational accidents occred are female workers in the “ Electrical Equipment Products Manufacturing” and “Textile Products Manufacturing” sectors.

The prediction model was developed to forecast the number of occupational accidents for female people suffered in the Elecrical Equipment Products Manufacturing Sector from the sector where the most occupational accidents occured. If we look at the calculations, we estimate that the number of occupational accindents in this sector is increasing. In order to improve the number of occupational accidents estimate, necessary calculations were made with statistical estimation methods, and then estimation errors were calculated by using MAPE method in order to determine the best estimation model afterwards. When we compared to the MAPE values, we saw that the best result was found by the Multiple Regression Analysis method. Therefore, Multiple Regression Equation, which takes years and the number of employees as independent variables, estimates the number of occupationa accidents based on female workers for the period between 2017-2021. As a result of the calculations made. It is expected that the number of occupational accidents will be between 250-300 in the future years. When the regression equation is examined, it is found that the number of occupationa accident is increasing with the number of employees. Estimates of the number of occupationa accidents for female workers were made using different estimation methods fort he Textile Products Manufacturing Sector, which is another sector where the number of occupational accidents is the highest. Prediction errors were calculated to determine the best prediction method, and the best prediction method based on MAPE results was found to be the Simple Exponential Correction Method. However, it is thouht that the fluctuations in the number of occupational accidents in this sector may be in the future years. Therefore we calculated the estimation only for the number of 2017 of occupational accidents.

When we examine the analyzes, it has seen that women are exposed to occupational accidents at a lower rate than men. While men are working in heavier jobs, it is effective for women to work in lighter jobs like jobs of assemble lines. When the results are examined, it is examned thar the number of occupational accidents are increasing. This suggests that the precautions on occupational health and safety are not enough and that workers and employers in occupational health and safety should be more conscious and that more precautions should be taken in this area. Bacause, compared with European Cuntries, turkey is located in the first place, unfortunately experienced inthe number of accidents at work.

Recommendations

In the following studies, it is thought that it is appropriate to study about the reasons for which most of occupational accidents happen.

References

Atwood, D., Kahn, F. & Veitch, B. (2006). Can We Predict Occupational Accident Frequency? Process Safety and Environmental Protection, 84(3), 208-221.

Ceylan, H. & Avan, M. (2012). Türkiye'deki İş Kazalarının Yapay Sinir Ağları ile 2025 Yılına Kadar Tahmini. International Journal of Engineering Research and Development, 4(1), 46-54.

Driscoll, T., Takala, J., Steenland, K. & Corvalan, C., Fingerhut, M. (2005). Review of Estimates of The Global Burden of Injury and Illness Due to Occupational Exposures. American Journal of Industrial Medicine, 48(2), 491-502.

Hamalainen, P., Saarela, K. & Takala, J (2006). Global Estimates of Occupational Accidents. Safety Science, 44(1), 137-156.

Hamalainen, P., Saarela, K. & Takala, J. (2009). Global Trend According to Estimated Number of Occupational Accidents and Fatal Work-Related Diseases at Region and Country Level. Journal of Safety Research, 40(3), 125-139.

Social Security Institution Statistics Annual, 2016

Takala, J. (1999). Global Estimates of Fatal Occupational Accidents. Epidemiology, 10(5), 640-646.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 368 - 376

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Social Media as an Educational Tool

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Abstract: With the high percentage of young people on social networks, where students feel at home, social media is no longer a trend, but part of everyday life and each year it becomes a greater part of education. It"s a way that students, teachers, administrators, and community members interact and exchange information with each other. Their experiences with technology, compared to those of teachers and administrators who possibly remember when the Internet came to fruition, are drastically different. This provides a very different understanding of the twenty-first century student as a digital native. Specifically, this study examined how schools and educators use social media, and whether being connected presents a better way to educate the twenty-first century learner. It investigated the level of parent and community engagement using social media and the students" perceptions of social media use in their education. Limited research exists on how teachers and schools actually use social media to enhance education and communication with school stakeholders, i.e., teachers, parents, students, and administrators. This empirical study attempts to fill this research gap and make some useful recommendations in the light of statistical findings.

Keywords: Social media, Empirical study, Student, Teacher, Parents

Introduction

Social media is no longer just a way to connect with family and friends. It has a wide range of uses, and various persons view it differently. In addition to using it to stay in contact with family and friends, many people use it as a source of daily news or instruction, to cultivate business contacts, or to connect to someone with a common interest (Whiting & Williams, 2013). Social media is unarguably part of everyday life, and each year it becomes a greater part of education (Mao, 2014). It is a way that students, teachers, administrators, and community members interact and exchange information with each other. Today, students can navigate the technological world with ease as digital natives, having grown up immersed in technology (Watson & Peccioni, 2011). Digital natives do not know a life without social media and Internet access. Their experiences with technology, compared to those of teachers and administrators who possibly remember when the Internet came to fruition, are drastically different. This provides a very different understanding of the twenty-first century student, a digital native (Howard, 2013).

Social media, also known as social-network sites, has many definitions and is understood in various ways, depending on usage. Mao (2014) defines social media as "new technologies and applications that use the Internet and Web 2.0 technologies and allow users to create and participate in various communities through functions such as communicating, sharing, collaborating, publishing, managing, and interacting" (Mao, 2014). Since various understandings of social media can influence their use, it is important to ascertain the perspectives of users — specifically students, teachers, administrators, and parents— in the context of education. In his study, Mao (2014) found that students feel schools should be more open-minded with regard to social media use, and communicate with them clearly about school social-networks policies.

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

The reasons for such an approach relate to the issues associated with use of social media on school campuses. Issues such as student and employee privacy top the list of administrator concerns (Wang, 2013). Concerns over privacy overshadow such concerns as student education and community engagement. A respondent (school principal) from Wang"s study (2013) states that he "firmly believes social media is not a fad but has unbridled potential in communication with parents and the community" (p. 57). The research shows that students" Internet connectivity, in general, is extremely high (Lenhart, et, al., 2015). This connectivity to social media potentially presents opportunities for student learning. Hrastinski and Aghaee (2011) found that more than 80% of students are willing to use instant messaging, such as Skype, to coordinate classwork and get quick answers. Few studies look at how social media could be or is already used across public-education institutions.

Although the percentage of students connecting through social media sites is high, not much has changed in the training of teachers to accommodate students" needs and learning patterns with regard to social media (Howard, 2013). Teachers often receive instructions not to use social media in the classroom, rather than an introduction to ways of safely and effectively using it.

The literature shows that students and teachers use social media inside and outside of school (Lenhart et al., 2015). According to Davis (2014), teachers and parents are already avid users of social media, but primarily in their personal lives. Davis (2014) surveyed more than one thousand full-time teachers and found that 80% use social media for personal use, while only 18% use it in the classroom. This shows that social media could be a common means of enhancing communication among all stakeholders within a public-education organization.
The goal of this study was to gain insight into the use of social media in classrooms, and for communication among students, parents, teachers, and administrators. To achieve this, the study explored how the observed high school uses social media. This research aims to assist administrators in navigating the online world, a natural environment for digital natives.

Specifically, this study examined how schools and educators use social media, and whether being connected presents a better way to educate the twenty-first century learner. It investigated the level of parent and community engagement using social media and the students" perceptions of social media use in their education. Limited research exists on how teachers and schools actually use social media to enhance education and communication with school stakeholders, i.e., teachers, parents, students, and administrators. This research addresses that gap in available research.

Literature Review

With the high percentage of young people on social networks, where students feel at home, social media is no longer a trend, but part of everyday life (Davis, 2010). "The bottom line is that people use social media and innovative technologies in their everyday lives" (Kelm, 2011, p. 519). The literature reviewed for this study aligns with Kelm"s (2011) findings. Many studies discuss the problems with social media use in public- school systems (Sawyer, Bemiller & Trendafilova, 2012; Careless, 2012; Davis, 2014; Howard, 2013; Mourlam, 2013). However, much less research specifically discusses student engagement and teacher involvement in the classroom.

Students

The advances and accessibility of technology have changed how students can be reached. According to Mourlam (2013), students would be open to using social networks they already know how to use, such as Facebook, to assist in learning new content in their classrooms. According to Mourlam (2013), students do welcome social media use, with at least one caveat—the content must be engaging and interesting. Further, Mourlam (2013) reports that 67% of students would find more interaction through Facebook appealing, and would have preferred to have all their assignments posted on Facebook.

Careless (2012) finds that when students get to use the Web and social media to collaborate with their peers in other schools, cities, or even other parts of the world, they are more engaged and actively participate in the lessons. According to Kelm (2011), when social media is used for educational purposes, much can be learned from simply observing young people using technology in everyday life. These observations can provide insight into enhancing classroom instruction, enabling educators to make use of the skills that students already have.

Teachers

The circumstances under which teachers must navigate the integration of social media into their classrooms and instruction are challenging. Teachers go through very little training to prepare for the evolution of the modem student (Plopper & Conaway, 2013). Although teachers are not being trained effectively, some teachers attempt to incorporate some new technology in the classroom. According to Plopper and Conaway (2013), 30% of teachers use podcasts and videos from social media sites to help their direct instruction.

While teachers use tools such as videos from YouTube, little is known of how they use other forms of social media inside the classroom. According to the definition from Anderson (2005) presented above, social media is a place where the students can come together with the teacher and other students to learn. Simply viewing a video on YouTube does not necessarily mean that social media is being incorporated into the lesson. Davis (2014) found that 80% of teachers use social media for personal and professional purposes, but only 18% integrate social media into their direct instruction.

This raises the question of how to promote collaboration between and among teachers and students, especially since both groups are already versed in the function of these sites.

In addition, due to policies of their educational institutions, many educators run into the barrier of being unable to access sites such as Facebook and Twitter on campus, due to social media policies that block them. Working with school administrators and technology officials to get them unblocked is a lengthy process. Teachers must be very clear and specific about the purpose for which they will use these sites (Davis, 2010).

This discourages educators from the idea of even attempting to incorporate social media into classrooms. Additional research into the educational uses of social media may help create a plan for teachers who would like to use these tools for instruction or communication with students and families.

School Administrators and Parents

In recent years, school administrations have introduced many initiatives to engage with their employees and the local community through social media. According to Fleming (2012), many schools use Twitter feeds, Facebook pages, and mass text-message systems, to reach out to parents of students with announcements in the form of one-way communication. Schools are increasingly creating web portals to make communication easier between parents and teachers, as well as to provide easy access to grades and assignments (Fleming, 2012). Despite this move toward the use of social media in schools, information is still lacking on what schools are doing to incorporate communication with their employees through social media (Rubin, 2014). In some cases, schools only allow using social media to communicate with their staff through the communication office, and this communication is strictly one-way, out to the community with announcements. Teachers and students may not even access sites such as Twitter during work hours.

In general, most schools are still skeptical about the benefits of social media in schools (Davis, 2010), amid concerns of cyberbullying, privacy issues, and access to inappropriate content. In some instances, such as the state of Louisiana, state law requires documentation of any and all interaction between teachers and students through any devices not issued by the school, including cell phones and email accounts (Davis, 2010). This is yet another reason that schools and educators still shy away from the use of social media in their classrooms or for outside-of-school projects (DiMarzo, 2012).

The discussion of social media use in educational settings by teachers, students, parents, and administrators often occurs in the context of Web interactivity that facilitates the desired engagement among publics. Definitions of interactivity vary, depending on the subject. According to Jensen (1998), interactivity in communication can be the way people adapt their behavior toward each other. An example is using the computer or other devices, such a smartphone, to communicate with others through social media (McMillan & Downes, 2000). Interactivity in communication is a relatively recent concept, and the definition is evolving with the use of technology and social media.

Looking at how schools use social media, six dimensions of interactivity can help in understanding social media use (McMillan & Downes, 1998): (1) direction of communication, (2) time flexibility, (3) sense of place, (4) level of control, (5) responsiveness, and (6) the perceived purpose of communication.

Method

Many research studies investigate social media use in the personal lives of teachers, parents, and students (Howard, 2013; Hrastinski & Aghaee, 2011; Mao, 2014). However, limited research exists on perceptions of using social media as an educational tool. To address the gap in the literature, a survey-based approach is preferred and an online survey was distributed via email in a high school.

The design of the survey considered three dimensions of interactivity: responsiveness, time flexibility, and sense of place. Questions specifically looking at responsiveness set a baseline for respondents‟ actual use of the various social media sites. Further, questions addressing time flexibility provided information about the best time to reach students to enrich their education and address issues about instruction or homework, either after school or during school hours. Finally, a set of survey questions that focused on a sense of place determined how these users utilize mobile Internet access, and if they are willing to use it to improve education for students.

The anonymous survey was designed for four different categories of respondents: students in grades 6-12, teachers of grades 6-12, parents of students in grades 6-12, and administrators. The survey for teachers included questions that looked into their use of social media, both personally and professionally, to collect data on teachers‟ basic understanding of how to use social media. This included their presence on many platforms, including Facebook, Twitter, YouTube, Instagram and Linkedln. The questions helped to determine what sites teachers might already be using, if any, to create a virtual presence for their students‟ learning and to connect with parents.

Students and parents received a similar survey. First, a set of questions collected data on their personal use of social media and their knowledge of these sites. Second, questions were included to gather data on their perception of using social media for learning, classroom engagement, and collaboration online. Also, the survey asked students questions about mobile access to their social media accounts.

Results and Discussion

At the end of the data collection period, 229 responses were collected, 9 of which were not completed. Among the responses were 22 from parents, 169 from students, 26 from teachers, and 9 from administrators. The majority of students participating in the survey reported being high-scb freshmen (n=57). Significant numbers of sophomores (n=40), juniors (n=36), and seniors (n=28) took the survey as well. The youngest participant (n=l) reported being in 6th grade. There were no respondents from middle-school grades 7 and 8.

Social Media Use Among Students, Teachers, and Parents

Understanding what a potential implementation of a social media policy might include calls for exploring how social media is being used in education, and the platforms that both teachers and students use most frequently. The participants reported time spent on the following social media platforms: (1) Twitter; (2) Instagram; (3) Facebook; (4) Snapchat; (5) Pinterest; (6) Linkedln; and (7) YouTube.

The results showed that students spend an average of 4.5 hours on social media each day. Parents spend an average of 3.4 hours each day on their preferred social media sites, and teachers spend an average of 1.7 hours each day on social media sites. The social media sites most frequently used by students are Instagram, Snapchat, and YouTube, with nearly 40% of students reporting that they use YouTube daily. The least used platforms reported by students were Facebook and Pinterest.

Table 1. Frequency of social media platforms use by students

	Never	N	Once a week	N	2-3 times a week	N	4-6 times a week	N	Daily	N
Twitter	9.2%	87	16.7%	20	15.7%	8	15.1%	11	8.9%	30
Instagram	5.8%	55	12.5%	15	21.6%	11	21.9%	16	17.7%	60
Facebook	11.3%	107	19.2%	23	7.8%	4	4.1%	3	4.7%	16
Snapchat	6.0%	57	6.7%	8	7.8%	4	16.4%	12	23.4%	79
Pinterest	11.8%	112	19.2%	23	9.8%	5	6.9%	5	1.2%	4
Linkedln	14.5%	138	4.2%	5	2.0%	1	0.0%	0	0.0%	0
YouTube	0.2%	2	5.0%	6	19.6%	10	19.2%	14	39.1%	132
Other	0.6%	6	2.5%	3	0.0%	0	1.4%	1	1.2%	4

Facebook was the most frequently used platform among parents, and 21% of parents reported using Facebook very often. Interestingly, parents rarely use Twitter and Snapchat. Teachers report using Instagram, Twitter, and Facebook most often, with 21% of teachers reporting that they use Facebook very often.

The data on social media frequency of use among teachers and students shows a generational gap in identification of the preferred social media platform. Generally speaking, the data demonstrated that parents and teachers use Facebook much more often than students, the majority of whom reported using Snapchat almost daily. At the same time, the data showed that students, teachers, and parents have a working knowledge of YouTube, and all use it rather frequently. YouTube appears to be the only common social media platform for all respondents and could be the common ground in creating a space for collaboration between the stakeholders in a school.

School Administration

With respect to the level of engagement, administrators shared their school‟s social media presence. To determine the frequency of updates, the scale was set from 1, the lowest (less than once a week), to 5, the highest (daily). Administrators reported that other administrative staff members do not often update the campus‟s YouTube and Facebook accounts (M=1.9, SD=1.1). Fewer administrators indicated that Twitter is updated on behalf of the campus as often as four to six times per week (M=1 .4, SD=1.4).

The survey also asked administrators to give an example of the content posted and the audience for which it is intended. Only four of the seven respondents answered the open-ended questions. Three of the four reported their campus‟s accounts were for celebrations of students, and two of them specified that the campus‟s accounts were for announcements and upcoming deadlines. Two of the four respondents identified the intended audience as students and parents, while the other two did not specify. When asked about the effectiveness of the use of social media sites to deliver announcements to parents, 66.7% of school administrators responding believed it is moderately effective. Additionally, 16.7% perceived social media to be moderately effective for obtaining feedback from parents.

The administrators‟ responses to survey questions show that they see the potential for social media use in education. One respondent described the battle to get students to use social media to network and learn in a positive way. In addition, two administrators stated they would be willing to develop a social media policy, while the other two stated that they would not be willing to develop a policy.

Teacher behaviors and practices concerning communication with students are a reflection of the school's policies. The data shows that students think that their teachers are open to online interaction, including email (M=3.47, SD=1.16). At the same time, students are not communicating with teachers using social media outside of class (M=1.75, SD=0.95). The student responses also indicate that students are not able to use social media platforms (not including email) to communicate while on campus, due to school network blocks (M=1.95, SD=1.34).

Students

The data demonstrate clearly that students frequently use their mobile devices (M=4.52, SD=0.93), such as their cell phones, to access social media accounts on campus and off campus. Most students agree that this is how they communicate with their peers (M=3.08, SD=1.3). Students‟ responses reveal that students rarely communicate with their teachers via social media, outside of school hours (M=1.75, SD=0.95).

The majority of students reported not using social media outside of school hours to get help with classwork (see Table 12). Yet, students are willing to use social media to communicate with classmates and teachers (M=2.86, SD=1.29), although they reported that currently such practice is not frequent (M=l .75, SD=0.95).

Teachers

Teachers reported that they spend an average of 1.7 hours a day on their social media sites—although teachers do not use it as a tool of communication for school purposes.

Similar to student responses, teachers‟ feedback show that they do not use social media to communicate with students about classwork. However, teachers sometimes use social media to interact with colleagues for planning purposes, showing that to some extent, they use social media to improve instruction in the classroom. It also shows that teachers and students agree that they do not interact on social media for assistance with classwork (M=1.75, SD=0.95; M=1.83, SD=0.96 respectively). Interestingly, students believe that they are sometimes required to communicate about classwork outside of class using social media (M=2.86, SD=1.09), while teachers reported that they rarely encourage it (M=2.04, SD=1.24).

The teachers‟ responses show that they generally use learning management sites, LMS, sites to interact with students (M=3.08, SD=1.41), but are open to the idea of learning to use other sites (M=3.04, SD=1.46). Like the students‟ responses, the teachers agreed that they do not use social media to communicate with students about classwork (M=1.83, SD=0.96). The responses illustrate that teachers are willing to learn more, and this would be an important insight for administrators to note if they do decide in the future to implement a plan.

Parents

The parents‟ responses demonstrate that parents highly appreciate and find it useful when administrators post updates on the campus‟ social media sites (M=3.89, SD=1.07). Parents regularly communicate with teachers online, most likely by email (M=3.63, SD=1.22). Given this information, it would be beneficial for parents to be able to post comments to teachers that might be helpful to other parents as well. This would save teachers‟ time spent answering the same questions for multiple parents.

The campus‟s social media accounts, such as Twitter, Instagram, and Facebook, are being updated four to six times per week, according to two respondents. No other updating of a social media site is reported. When campuses post updates to their sites so few times throughout the week, it represents another missed opportunity to reach parents.

While it is beneficial to know that parents visit the school‟s website for information (M=4.16, SD=0.99), parent responses indicate that they also find useful the school‟s posts of information about upcoming bond elections on its website (M=3.79, SD=0.89) or general information on its social media sites (M=3.37, D=1.09). Despite the number of parents that visit school websites and social media sites for school information, parents report that they do not use social media to communicate with their child‟s teachers (M=1.37, SD=0.48)

Conclusion

Social media can be a way to enrich education, and a key factor in the communication among students, teachers, parents, and school administrators. The results of surveying students, teachers, and parents show that perceptions toward learning in general are positive. The open-ended questions to which administrators responded show that getting them to commit to the idea of social media as an educational tool would require more education on their part. It could take many more studies such as this one to reveal to administrators and teachers the perceptions of parents and students about social media use.

The major finding of this study was that the perceptions of students, teachers, parents, and administrators, regarding the future use of social media as a tool in education, do not align. The responses show that teachers and students have positive attitudes toward learning more about the use of social media in the classroom. Likewise, parents appreciate when the school uses it as a way to distribute information. The study also revealed major differences among students, teachers, and parents in the current use of social media. Administrators took a rather strong stance against social media use as a classroom tool, as well as the possibility of developing a system to enable using it in the future.

The administrators that responded clearly felt that potential issues surround the use of social media, although further research would need to be conducted to fully understand what those problems could be. Since the majority of administrators who responded did not already have a social media policy in place, nor did they plan on having one, it could be assumed that they fear the worst. Consistent with DiMarzo‟s (2012) observations, it is possible that the administrators do not allow the use of social media for the sake of student privacy, or to ensure no inappropriate communication could occur. This also echoes Davis‟s study from 2010, which discusses administrator skepticism in regard to social media use. Although some administrators did mention benefits of social media, including the benefit of "meeting people where they are," demonstrating the current frequency of social media use among students would be pivotal. This could be a step in the direction of implementing a social media plan.

Careless (2012) argues that when students use the Web and social media to collaborate with peers from their school or other schools, they are more engaged in the lesson. This information, combined with the data found in this study, shows some benefits of developing a policy to incorporate social media into education. Plopper and Conaway (2013) found that teachers were already trying to implement new technology for instruction in the classroom. According to their study, 30% of the surveyed teachers incorporated videos from social media to enrich lessons. The data in this study similarly show student and teacher interest in this learning strategy.
The results of the present study also show that parents‟ perceptions of social media are positive when it comes to communicating with teachers and the administration. Social media use by parents is fairly high, especially on sites such as Facebook. Analysis revealed that parents appreciate the access to information shared on social media. Almost half of the parents report using Facebook often, and almost a third use Facebook very often. Parents reported that they spend an average of 3.4 hours per day on social media. This demonstrates that social media is a viable tool for the school and the teachers to deliver information to parents, as well as an opportunity to receive invaluable feedback.

The responses show that teachers spend a substantial amount of their personal daily lives on social media as well. In general, teachers seem to be open to the idea of using sites with which they are already familiar. Part of the reason teachers have a hard time adopting social media for instructional use is the rapid growth and development of new platforms and LMS sites; yet, teachers do not get the level of training necessary to effectively use the new technology. This finding echoes Davis (2014), who argues that teachers do not get the training necessary to make new technology successful. Arguably, students do not receive any training on how to use social media for schoolwork either, and it is up to the teacher to take time out of instruction to teach students how to effectively use another online platform. Teachers are already using social media, but both students and teachers report that it is not being used to enrich classroom materials or communication.

Students report that they are online a significant 4.5 hours per day. However, the students and the adults in the study frequent different sites. Students are mostly using Snapchat and YouTube. Teachers and parents report using Facebook and YouTube most frequently. Fortunately, there is one important commonality between teachers and students: YouTube, a resource used across the board, with more than a third of the students using YouTube on a daily basis. Again, this is an opportunity on which schools and teachers could bank to reach students and to enrich their education. YouTube is a space with an abundance of content and collaboration opportunities.

When thinking about integrating YouTube into instruction, an important consideration is that it can be an open network platform— i.e., students do not have to have a YouTube account to access public content. Teachers can benefit from creating content or posting student content in a space that any students can view. Luckily, the findings of this study show that a large number of students use YouTube daily. If those users already have an account, true collaboration can take place in the YouTube space, with sharing of students‟ and teachers‟ content, while commenting on and subscribing to each other‟s content.

In fact, YouTube, Facebook, and Instagram can all potentially be used as open networks, allowing for easy implementation in the classroom. In addition, monitoring the activity on open networks is much easier. Compare this to the Snapchat, also highly used by students according to the findings, but much more difficult to imagine in classroom use. Additionally, open networks provide a level of transparency needed for schools. Administrators, or other faculty and staff, could easily monitor activity and hold students accountable.

The policies for most of these platforms require the user to be at least 13 years of age. With that in mind, the issue of asking a student in the 6th grade, who might still be too young to meet that requirement, to use social media would be problematic for schools. Moving forward, this research would be better applied to schools with grades 9 - 12 only, using 8th grade as a transition year in which to begin training students on best practices for educational social media use.

This study has determined that there are, in fact, missed opportunities to engage with students in their learning, and with parents as key stakeholders in the students‟ future. Almost all students believe that their teachers would be open to more online communication; at the same time, they acknowledge that communication on social media is currently lacking. That is where the school comes in. It is up to the school administrators to make clear what is appropriate and what is not, through a solid social media policy, and with proper teacher training. First, however, sites like YouTube would have to be unblocked from the school‟s Internet network.

Social media is here to stay, with or without the integration of social media as a tool in the public-education system (Davis, 2010). People are using it in their everyday lives (Kelm, 2011). This research helps inform understanding of the best ways to properly and efficiently integrate social media into the classroom communication strategy.

References

Anderson, T.T. (2005). Distance Learning: Social Software‟s Killer App?. Paper Resented At The ODLAA, Available at: http://citeseerx.ist.psu,edu/viewdoc/download?doi'/4l0.1.1.95.630&ep!/4repl&typ e'Apdf (accessed 2018).

Careless, J. (2012). Social Media: It Does Have A Place In The Classroom. *Tech Learning*., Retrieved November 28, 2017. www.techleaming.com /article/52186

Davis, M. R. (2010). Social Networking Goes To School. *The Education Digest*, 76(3), 14.

Davis, M. (2014). Teachers Found To Avoid Social Media In Classroom. *Education Week*, 4. Retrieved December 2, 2017. http://blogs.edweek.org/edweek/DigitalEducation/2014/01 /suvey_teachers_shy_away_fro m_e.html

Di Marzo, G. M. (2012). Why Can‟t We Be Friends? The Banning Of Teacher-Student Communication Via Social Media And The Freedom Of Speech. *American University Law Review*, 62(1), 123-166

Fleming, N. (2012, November 7). Districts Deploy Digital Tools To Engage Parents. *Education Week*, 32(11), 16-17.

Howard, K. (2013). Using Facebook and other SNSs in K-12 Classrooms. *Issues in Teacher Education*, 22(2), 39-54.

Hrastinski, S., & Aghaee, N. M. (2011). How Are Campus Students Using Social Media To Support Their Studies? An Explorative Interview Study. *Educational and Informational Technologies*, 17(4), 451-464

Jensen, K. B. (1998). Interactivity in the wild. An empirical study of „interactivity‟ as understood in organizational practices. *De Gruyter Open,* 10.1515/nor-2017-0244.

Kelm, O. (2011). Social Media: It‟s What Students Do. *Business Communication Quarterly*, 74(A), 505-520.

Lenhart, A., Duggan, M., Perrin, A., & Stepler, R. (2015). Teens, Social Media, & Technology Overview. Pew Research Center. Retrieved Sept. 12, 2017. http://www.pewintemet.org/files/2015/04/PI_TeensandTech_Update2015 0409151 .pdf.

Mao, J. (2014, April). Social Media For Learning: A Mixed Methods Study On High School Students‟ Technology Affordances And Perspectives. *Computers in Human Behavior*, 33, 213-223.

McMillan, S. J., & Downes, E. (1998). Interactivity: A Qualitative Exploration Of Definitions And Models. *Annual Convention of the Association for Education in Journalism and Mass Communication*, Baltimore, Maryland.

Mourlam, D. (2013). Social Media And Education: Perceptions And Need For Support. *Journal on School Educational Technology,* 9(3), 23-28.

Plopper, B., & Conaway, A. (2013). Scholastic Journalism Teacher Use Of Digital Devices And Social Networking Tools In A Poor, Largely Rural State. *Journalism & Mass Communication Educator*, 60(1), 50-58.

Rubin, D. (2014). Social Media In The Schools. *The Computer & Internet Lawyer*, 31(1) 10-16

Sawyer, T. H., Bemiller, J., & Trendafilova, S. (2012). Social Media And Free Speech In Education And Sport. *Journal of Physical Education, Recreation & Dance*, 83(1), 7-56.

Wang, Y. (2013). Social Media In Schools: A Treasure Trove Or Hot Potato. *Journal of Cases in Educational Leadership*, 16(1), 56-64.

Watson, J., & Peccioni, L. (2011). Digital Natives And Digital Media In The College Classroom: Assignment Design And Impacts On Student Learning. *Educational Media International*, 48(4), 307-320.

Whiting, A., & Williams, D. (2013). Why People Use Social Media: A Uses And Gratifications Approach. *Qualitative Market Research: An International Journal*, 16(4), 362-369.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 377-380

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Information Technologies in a Modern School

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Abstract: Any educational institution chooses for itself valuable reference points of development. The result of the quality of education largely depends on what position the educational institution will take in relation to schoolchildren. For us, the development of a Specialized Boarding school-lyceum "Information technologies" is the development of our students, ensuring their success in life. To achieve these goals in the implementation of the educational program of the school-lyceum staff there was a need to study and implement modern pedagogical technologies and innovative forms of education. The school-lyceum carries out activity in the STEAM direction with training in three languages with profound studying of computer science, mathematics, physics and other disciplines of applied character. The concept of the boarding school incorporates the best international experience in the construction of an educational model for the creation of information and educational space, favorable for the harmonious formation and development of the individual capable of self-development, self-determination and self-realization in the modern information society. The article reveals the peculiarities of studying in a Specialized Boarding school –lyceum "Information technologies", the ultimate goal of which is the formation of the basic, social, profile competence of the student.

Keywords: Education, School, Information technology, Robotics, STEAM

Introduction

Modern reforms in the country, the rapid informatization of the society and dynamics are fundamentally changing the education requirements.

Today, the level of education of a person directly affects his ability to work, competitiveness. Innovation is the secret to success, according to the Organization for economic cooperation and development. The modern period of development of education in the Republic of Kazakhstan is marked by large - scale pedagogical innovations aimed at improving the quality of education-it is the updated content of education, new author programs, the development of innovative educational projects, the emergence of new types of educational institutions.

The adoption of the state program" Digital Kazakhstan " actualizes educational decisions on the implementation of the provisions of the Program in school education by qualitative changes in its information technology content.

In the era of information globalization and rapid evolution of technologies are increasingly in demand profession related to engineering, science, IT-technologies, etc. Sharp increase in the needs of society in terms of forced industrial-innovative development in people with non-standard thinking, making new content in the industrial and social life, able to set and solve new problems related to the future, and led to a qualitative leap in the development and implementation of information and communication technologies in practice.

It is this context of the development of the education system that has become a challenge for the opening of an innovative school in our region - Specialized boarding school-lyceum "Information technologies".

School-Lyceum "Information technologies" was founded in September 2017, is located in the city of Karaganda is a large industrial, scientific and cultural center of Kazakhstan. The city has large coal mining enterprises, machine-building, metal-working and food processing enterprises, a large number of transport and communication enterprises.

The mission of the school is aimed at promoting the development of engineering education in Kazakhstan through the introduction of innovative educational system model STEAM-direction focused on the best Kazakh traditions, international experience and practice in the development and use of information technology in teaching. The overall objective is to develop students ' individual, creative and research skills through active learning and the use of information and communication technologies and robotics.

Education at school is conducted from the 7th grade in three languages: state, Russian and English. The educational process is built in combination of traditional values with new ideas of development. The basic values are tolerance, harmonious development of the child's personality, the basis of life is healthy lifestyle, family values, understanding the value of education.

Today, at school, education is focused on the model of education associated with the standards adopted in the modern business world - functional literacy, competence, knowledge of several languages, computer skills and as the ultimate goal – access to the international educational space. The main criterion of success of educational activity of school is achievement of the level of education corresponding to the international standards for its continuation in any country of the world.

The implementation of the school model is carried out in accordance with the curriculum, ensuring compliance with the requirements of state educational standards and maintaining the variable component: grade 7 – personality-oriented education through research activities of a research nature, aimed at the development of creative abilities, grades 8-9 – individual trajectory of development of students through socially significant projects, grades 10-11-practice – oriented education through project activities and technology startups.

Given the nature of the school is the basis for the organization of educational process based on the following competencies: grades 7-9 – the basic skills of working with digital information, methods of its production, transmission and storage; laid the foundations of programming, robotics and 3D simulation; beginning of work in complex software environments; grades 10-11 – formed in-depth skills in the software environment, the ability to independently develop software code; the skills of modeling and design of robotics and engineering systems, active use of modern information and communication technologies are formed.

Taking into account the direction of profile of Lyceum education of information culture of Lyceum students is a task not only teachers of Informatics, but also teachers – subjects, as information culture today becomes a component of the General culture of the person. ICT is integrated into all teacher training programs. In Lyceum the single information and educational space by the maximum computerization and internetization of all directions of educational process is created.

We live today in a world of high technology, but in many countries of the world there is a shortage of scientific and technical personnel. That is why the so-called STEAM education is widely spread. The need for the formation of the STEAM-educational environment in Kazakhstan is relevant not less than in other countries. This approach is successfully implemented in innovative schools of higher level of Mathematics, Computer science and Natural Sciences in Kazakhstan. In order to implement the educational policy in the field of STEM education, it is planned to strengthen the elements of this approach in educational programs aimed at the development of functional literacy of students in mastering modern technologies, skills of research and project work. In this regard, within the framework of updating the content of education, the implementation of early education in the basics of Natural Sciences and information literacy has begun. Taking into account the possibilities of the Lyceum, several approaches have been chosen::
- integration of Computer science with all disciplines;
- implementation of a research project for students in the framework of existing STEAM-objects for achieving the most significant results;
- STEAM as an addition to the school curriculum..

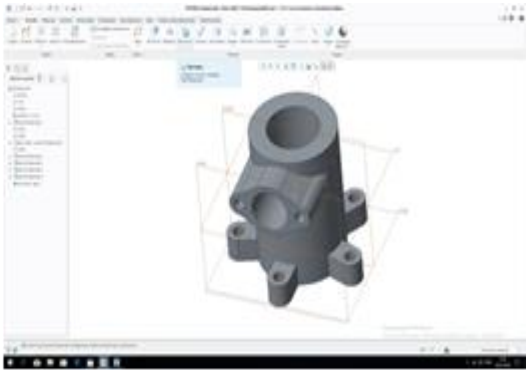
The Lyceum has a laboratory of design, robotics and artificial intelligence. The main activities of the laboratory - software development, design and programming of Android robots, the development of mobile robots.

The course of robotics is a series of courses on robotics, which is training in the Assembly and programming of various robots (Mbot, AirBlock, UnoCraft) and the creation of robots on Board Arduino.

With block programming, students create their own interactive programs, animations, games, music applications and creative projects - and share them with all Internet users.

The program "Learning Arduino using The C++ programming language" taught students to design electronic devices based on the Arduino microcontroller platform, which helps to acquire engineering skills and has a scientific and technical orientation.

The school participates in the educational project "Engineers of the future". School students realize their development in the program Creoparametrix, making different models on a 3D printer. Students learn engineering 3D modeling and prototyping.




The course "IT Essentials" Cisco Networking Academy helps to learn how to assemble and configure a computer, it is safe to connect it to the network, to take the first step towards a career in it. It develops critical thinking and problem-solving skills using real-world equipment and the cisco packet tracer network configuration simulation tool.

The acquired skills students can demonstrate at various competitions and contests: the international festival of robotics "Roboland" (Karaganda), the international Olympiad INFOMATRIX (Almaty, Suleyman Demirel University), the world Olympiad in robotics (WRO).

Conclusion

Based on the mission and goals of our Lyceum, it is important for us to create an information and educational space that is favorable for the harmonious formation and development of a person capable of self-development, self-determination and self-realization in the modern information society; mastering technological and engineering skills that open up opportunities for innovative solutions to modern problems; increasing the motivation of students to choose engineering professions and create a system of continuous training of future qualified engineering personnel with academic knowledge and professional competencies for the development of priority areas of national science and technology, the ultimate goal of which is the formation of the basic, social, profile competence of the student.

References

The Message of The President of The Republic of Kazakhstan N..Nazarbayev to people of Kazakhstan dated January 31, 2017, "The Third modernization of Kazakhstan: global competitiveness" and "Ruhani zhangyru"(from kaz. “Spiritual revival”);

Strategy "Kazakhstan-2050". A new political course of the established state. The Message of The President of The Republic of Kazakhstan - Leader of The Nation N. A. Nazarbayev to the people of Kazakhstan dated December 14, 2012

The concept of innovative development of the Republic of Kazakhstan until 2020. Astana,2013.

State program "Digital Kazakhstan-2020", Astana, 2017

State program of development of education and science of the Republic of Kazakhstan for 2016-2019

Methodological recommendations for the implementation of STEM education. - Astana: national Academy of education named by I. Altynsarina, 2017. - 162 p.

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The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2018

Volume 9, Pages 381 - 387

ICEMST 2018: International Conference on Education in Mathematics, Science and Technology

Research Studies of Computer-assisted Instruction in Mathematics Education: Examination of Turkish Graduate Theses Completed between 2005-2016

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Abstract: The rapid development and diffusion of technology dramatically change the power balances/relations and competition areas among the countries. In order to keep up with such a transformation and to become an arbiter or an entitled shareholder, countries strive to get benefit from the latest technology in their all institutions. Intensive effort and studies are being conducted especially on the information and technology oriented economy and growth. One of the fundamental requirements for success in this issue is to train entrepreneur citizens that are aware of the potentials of technology and able to use technology for production through integrating technology in educational contexts. Computer-assisted instruction (CAI) is one of the applications to help in the way of fulfilling this goal. Defined as making use and taking the advantage of computer technologies in teaching-learning activities, CAI aims to provide students with effective and enriched educational experiences that can ideally serve their needs and interests. Computers are also used in mathematics education where analytic processes such as calculation, visualization, prediction and intuition, modeling and generalization are required. The potentials of CAI in mathematics education have been explored in research studies. Examination of these studies is important in order to follow rapidly changing computer applications and related research trends in this area. Therefore, using a content analysis, this study aims to provide an overall evaluation of Turkish graduate thesis focusing on the use of CAI in mathematics education completed between 2005 and 2016. A total of 83 theses were recruited through relevant searches on the online database of Higher Education Council. They were carefully read and the necessary information was transferred to the Microsoft Excel environment using the 4N1K literature review method. Then, the information about each study was coded in terms of research problem, CAI application employed, main variables, research methods, sampling, data collection and analysis methods and results and then converted into frequency and percentage tables.

Keywords: Mathematics education, Computer-supported instruction, Graduate thesis, Content analysis

Introduction

In the information age, we are experiencing very rapid advances in technology and its implementation in every aspect of our lives. In line with these advances, technology has also entered our education systems. In earlier times, the main and central element in education was the teacher, and his/her companion was the classroom and the blackboard. In time, the blackboard and chalks were replaced by whiteboard and felt-tip pens respectively. Recently, interactive boards, tablet computers and instructional software have started to take part in education.

Individuals usually attempt to handle, minimize or overcome the problems with which they face during their lives. The tools and characteristics they own including their education are the biggest support in this endeavor. One of the objectives of the education is to increase the number cells working in the human brain, which is possible with thinking. Mathematics is the primary subject that teaches how to think (Kart, 2002).

- Selection and peer-review under responsibility of the Organizing Committee of the Conference

Various objectives are determined to improve the quality of mathematics education at every stage of the education system. Possessing mathematical concepts, gaining problem solving skills, having confidence in mathematics, and gaining a positive attitude towards mathematics are some of these goals (Baydar & Bulut, 2002). In order to achieve these objectives, computer-assisted mathematics teaching can be implemented as an instructional strategy by using the advances in educational technology.

As a general concept, computer-assisted instruction briefly means some way of benefiting from the computer and its applications in the teaching and learning processes in the schools. Its purpose is to provide students with an effective and rich learning-teaching experience that will best meet their interests and needs. The rationale for using such a strategy includes but not limited to being able to catch up with the changes and increases in today's knowledge base (lifelong learning), sustaining in the technology-intertwined society (networked or digitalized community), necessity of using information and communication technologies in every profession (21st century skills), and increased demand for education (distance education, personalized learning). Some potentials of using computers in education consist of multimedia, individual learning, visualization, enriched interaction, quick feedback, repeated use, safe observation, high motivation, and time and resource saving (Yanpar, 2007). The variety of computer-assisted instructional applications can be grouped under such categories as drill-and-practice, tutorial, simulation, instructional game, and problem-solving (Doering & Veletsianos, 2009).

The use of computer as a cognitive tool in mathematics teaching is called computer-assisted mathematics instruction (Baki, 2002). The more important feature of the computer than it can be used as an effective computing tool in the teaching process is that it can carry the abstract mathematical concepts to the screen and embody it (Baki, 1996; Özdemir & Tabuk, 2004). Therefore, today’s teachers are expected to integrate educational technologies to train individuals who have effective thinking habits such as analytical and critical thinking. Similarly, scholars in mathematics education field are also expected to scientifically investigate the potential consequences of using computer applications on students’ mathematical outcomes.

As known as a general rule of research, a new scientific study that will be conducted in any field takes its theoretical and methodological base from the related studies already completed and interprets its findings in this context. Such an approach helps researchers know previous problems, theoretical foundations, research methods and techniques. The detailed examination of prior studies is important in terms of evaluating the historical development of the related field, determining the current issues and trends, and directing possible future studies. It is especially crucial in areas such as educational technologies that show rapid development and change. In fact, it is thought that it will be useful to periodically analyze the information that is in continuous change and to apply it in research and development as well as teaching processes. Moreover, it will assist new master and doctorate students to concentrate on original and contemporary research topics in their academic studies. With this in mind, this study aims to survey and analyze the empirical literature related to the application of computer-assisted instruction in mathematics education. It is limited to studies which were conducted in Turkey, written in Turkish language, prepared as a graduate thesis (master and doctoral), completed in the last decade (2005-2016). The following main questions guided this study:

1. How was the number of studies distributed across the years?
2. What were the research problems and main variables?
3. What kinds of computer-assisted applications were employed?
4. How were their research problems investigated in terms of research designs, sampling strategies, data collection approaches, and data analysis techniques?

Method

This study was designed as a historical survey which involved document analysis. In these type of research studies, researchers usually employ content analysis techniques to review written materials (diaries, newspapers, official documents, compositions, etc.) that contain information about the cases that are intended to be investigated. The rich data contained in these documents are very effective in describing the research topic in a multifaceted way and in determining how it develops in the historical process (Cohen, Manion & Morrison, 2007).

Turkish master and doctoral thesis completed between 2005 and 2016 were treated as documents or data sources for this study. These theses were recruited through online searches on the database of National Dissertation Center managed by Turkish Higher Education Council. The abstracts of dissertations were carefully read to determine their suitability to be selected as a data source. After this initial review, a total of 83 studies were selected as appropriate for further investigation.

Collected theses were analyzed using descriptive content analysis, which consists of such stages as (a) coding the data, (b) creating possible themes, (c) organizing themes, and (d) presenting findings (Yıldırım & Şimşek, 2011). Textual content analysis often involves the elucidation of meaning and conclusions from texts through the reduction of large-scale texts with many words to summative themes with fewer words and categorization of similar themes under common conceptual structures (Weber, 1996). In this study, each thesis was thoroughly read and an annotated bibliography was created by coding their texts in accordance to the research questions. Next, a database of coding results was developed in MS Excel. The results were then presented by using frequency tables and graphs.

Results and Discussion

The distribution of the number of theses by years is given in the line graph in Figure 1. As can be seen from the graph, the number of studies was stable until 2009 and it sharply increased in 2010 and made a peak in 2011. It remained high and stable in 2012 and 2013 but dramatically decreased in 2014. Hence, there was a jumping/inflation in the numbers between 2010 and 2013. When the changes between the years are examined, the rapid increase in the number of theses between the years 2005 and 2006 (500%) and the decrease between 2013-2014 (54.5%) are significant. The increase between 2009 and 2011 (180%) can be explained by the fact that the FATIH Project was started in 2010. In other intervals, gradual increases and decreases are observed.

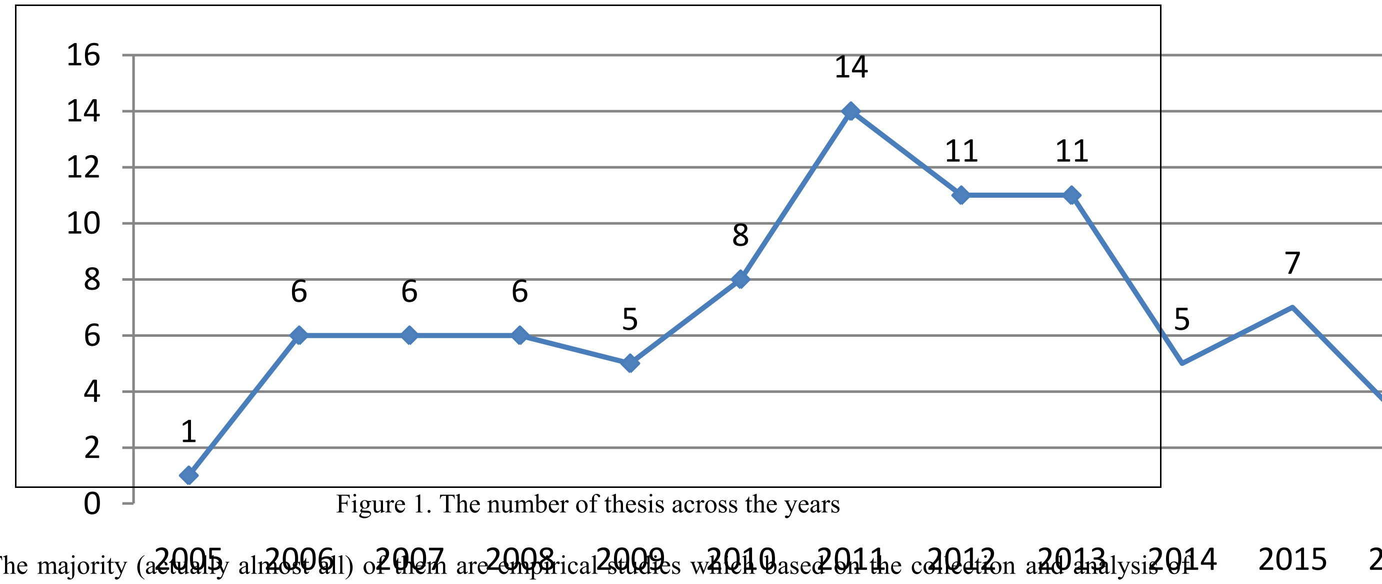

Figure 1. The number of thesis across the years

The majority (actually almost all) of them are empirical studies which based on the collection and analysis of some sort of data. A few of them were theoretical ones like instructional designs, modeling and discussions. Only two were review studies including chronological analysis and comparisons.

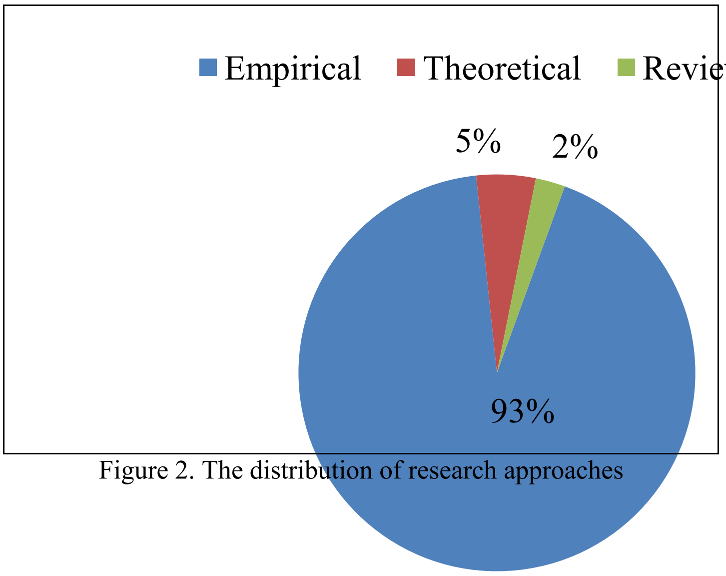

Figure 2. The distribution of research approaches

For example, the problem of a theoretical study is "how should a computer-assisted instructional design of the permutation and probability unit be designed in the 8th grade mathematics education curriculum?". One of the two review studies examined historical development of computer-assisted mathematics education and the remaining investigated the comparison of open source software used in mathematics education.

The distribution of research methodologies employed in the theses is presented in Table 1. Half of them employed quantitative, a one third employed qualitative (this is interesting for math researchers), and almost a quarter of them used mixed methods. All quantitative studies were experimental in nature, which include the manipulation of independent variables, mostly in the form of using computer-assisted instructional applications in math courses, and then observing possible consequences on some dependent variables. Regarding experimental designs, only two were true experiments with randomized assignments of subjects. The remaining was almost evenly distributed as quasi and poor experiments. No studies were found descriptive in nature. For those who employed qualitative research approaches, a little more than half were designed as a case study and the remaining were equally distributed as grounded theory and action research.

Table 1. The distribution of research methodologies

Research paradigm	Research model	f	%
Quantitative	True experimental	2	2.4
	Quasi-experimental	20	24.1
	Weak experimental	19	22.9
	Single subject experimental	1	1.2
Qualitative	Grounded theory	5	6
	Case study	14	14.5
	Action research	5	6
Mixed		16	19.3

Table 2 demonstrates the sample distribution of theses. The range of subjects was quite diverse. However, the most focused population was secondary school students (almost half), followed by undergraduate students (a quarter), and high school students. Only two studies explored graduate students including both master and doctoral levels. As far as the sample size was concerned, most of the studies were conducted on relatively small samples with no more than 50 students. In fact the majority (91%) were carried out with 0-100 participants. This is because of the fact that most used experimental and qualitative models.

Table 2. Sampling by level of education

Sample	f	%
Primary education	5	5.7
Secondary education	37	42.5
High school	14	16.1
Undergraduate	20	23
Graduate	2	2.3
Instructor (teacher, academician)	6	6.9
Other	3	3.5

The distribution of computer-assisted instructional applications is shown in Table 3. The dominant type of computer-assisted instruction in the studies is tutorial (instructional software that is specially programmed to teach content knowledge), followed by problem solving applications. Simulation includes augmented reality; drill-and-practice helps students to perform lower level skills automatically. Computer games allow students learn math concepts and skills by playing and entertaining. Tutorials included GeoGebra, Cabri, Geometer's Skechpad, Derive, MS Excel, and so on. GeoGebra, Derive, Maple, Cabri, 3D Studio Max and Geometer's Skechpad were also employed for problem-solving. Regarding those theses used computer game, one employed 3D Minecraft game and the other employed researcher-developed games based on Java and Netbeans.

Table 3. Computer-assisted instructional applications used in the theses

Application	f	%
Simulation	1	1
Tutorial	88	87.1
Problem-solving	8	7.9
Drill-and-practice	1	1
Computer game	2	2
Other (Webfolio)	1	1

Figure 3 summarizes the number of variables studies in the theses. The most investigated variables were achievement (represent the comprehension of math concepts), attitude (including motivational characteristics of math content), students' satisfaction from computer-assisted instructional applications, and higher order thinking skills such as criticizing, analysis, synthesis, logic, creativity and so on. As expected, these variables were treated as dependent/outcome variables in the thesis. The usability category involved the usability or functionality of the computer-assisted applications used in the studies.

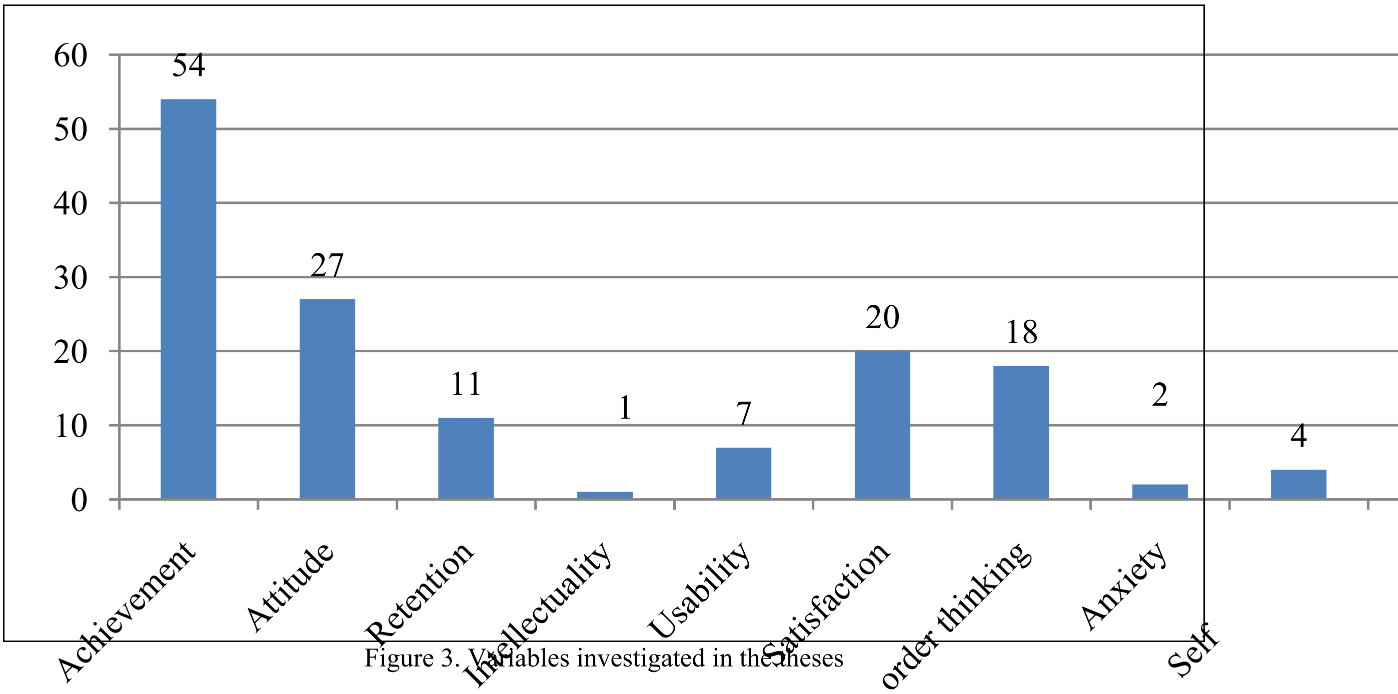

Figure 3. Variables investigated in the theses

The distribution of data collection tools employed in the theses is presented in Figure 4. As expected, the usage of data instrumentation was dependent on the variables investigated. The most frequently employed tools were achievement test (31%), scales (especially measuring affective/motivational characteristics), interviews with those students who used computer-assisted instructional applications, and observations including students' usage of these tools and tracking their eye movements. Documents included scientific reports, student artifacts, alternative measures such as webfolio and self-evaluation reflections. The majority of the achievement tests and scales included multiple-choice and Likert-type questions respectively. Most interviews were semi-structured. Ability testing instruments included mental rotation test, spatial visualization test, and number sequence memory test.

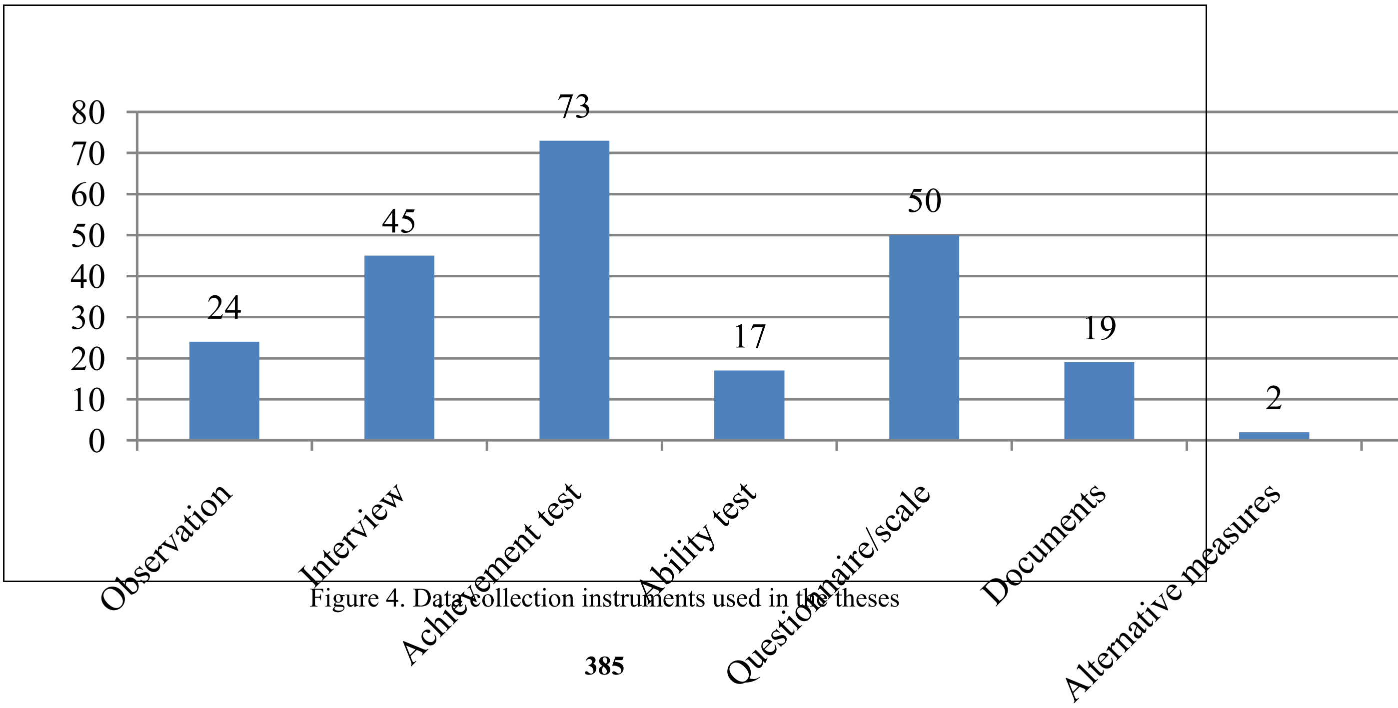

Figure 4. Data collection instruments used in the theses

Table 4 shows the distribution of data analysis techniques utilized in the theses. Most studies applied descriptive statistics including frequency analyses, central tendency and dispersion to summarize their variables. Almost all studies applied inferential stats to examine relationships and differences among the variables. Of these, t-tests were the most employed technique followed by ANOVA tests. Qualitative studies utilized content analysis techniques.

Table 4. Data analysis techniques employed in the theses

Technique	f	%
Frequency and percentage	15	7.7
Mean and standard deviation	21	10.8
Data visualization	7	3.6
t-test	45	23.1
ANOVA	14	7.2
ANCOVA	7	3.6
MANOVA	2	1
MANCOVA	3	1.5
Correlation/regression analysis	12	6.1
Factor analysis	2	1
Non-parametric tests	20	10.3
Content analysis	47	24.1

Conclusion

The number of Turkish graduate thesis focusing on using computer-assisted instruction in the field of mathematics education has been increasing by 2010. The inflation between 2010-2013 can be explained by the start of FATIH project. FATIH is a nation-based reform through which all classrooms were equipped with interactive boards and students were given a tablet PC. Also, a big depository of instructional software and materials, which is called EBA, was open to teachers' usage. Professional development programs about technology integration were offered to teachers as well. Therefore, this obviously attracts mathematic education scholars to conduct technology-related research studies. Almost all theses examined in this study utilize tutorials. Future studies should be canalized to simulation, problem-solving apps and games, which are known to be useful for mathematical reasoning.

Quantitative research methods, especially experimental designs with small samples are prevalent among the thesis. Scholars are mainly interested in comparing traditional teaching methods with technology enhanced ones. No descriptive design within the quantitative research paradigm was employed. Hence, future studies can focus on larger scale surveys to explore associations among the variables.

Theses frequently explore the possible effect of computer-assisted instruction on math outcomes of students enrolled in fifth grade to university. Future studies may focus on investigating the potentials of computer-assisted instruction on primary school students' (1-4 grade) math learning. Achievement and attitude seem to be adequately studied. Future studies should give more attention to math variables such as anxiety and higher order thinking skills.

References

Baki, A. (1996). Matematik öğretiminde bilgisayar her şey midir? *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *12*, 135-143.

Baki, A. (2002). *Öğrenen ve öğretenler için bilgisayar destekli matematik*. İstanbul: Ceren Yayın Dağıtım.

Baydar, S. C., & Bulut, S. (2002). Öğretmenlerin matematiğin doğası ve öğretimi ile ilgili inançların matematik eğitimindeki önemi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 23*, 62-66.

Cohen, L., Manion, L., & Morrison, K. (2007). Research methods in education. New York: Routledge Publication.

Doering, A., & Veletsianos, G. (2009). Teaching with instructional software. In M. D. Roblyer & A. Doering (Eds.), *Integrating Educational Technology into Teaching* (pp. 73-108). Upper Saddle River, NJ: Pearson Education.

Kart, C. (2002). Matematik eğitimi ve öğretimi. *Çağdaş Eğitim, 291*, 7-10.

Özdemir, A. Ş. ve Tabuk, M. (2004). Matematik dersinde bilgisayar destekli öğretimin öğrenci başarı ve tutumlarına etkisi. *Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 3*(5), 142-152

Yanpar, T. (2007). *Öğretim teknolojileri ve materyal tasarımı*. Ankara: Anı Yayıncılık.

Yıldırım, A., & Şimşek, H. (2011). *Sosyal bilimlerde nitel araştırma*. Ankara: Seçkin Yayınevi.

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Design Change Management Process Follow-Up

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Abstract: Today, with the rapid development of technology, the diversity of customer desires and requests is increasing. Companies are working to respond to these changes and requests. Defense industry is one of the sectors that are sensitive in this regard. It is very important that the changes are managed and implemented in a harmonious and correct manner. When these changes are made, communication should also be very careful. In the context of this study, a literature survey on process management and change management was conducted first. How to deal with process and change management in a company operating in the defense industry is then elaborated on the basis of the manufacturing process of a defense vehicle. First, it is determined which process the product was produced through. Based on this review, the process map for the product is drawn. Possible changes in processes to increase fertility have been studied. Processes and processes that do not add unnecessary and value added for the desired process improvement have been eliminated. Thus, it has been decided that performance and customer satisfaction can be increased. To capture a good level of customer service, business processes have been defined that reduce deviations from the delivery of work.

Keywords: Management, Design, Process management

Introduction

The process is a series of activities that have inputs, add value to them, and produce output. In other words, the process is the sum of the people, equipment, materials, methods and environmental elements that interact with each other to produce a certain output. The process is defined as "interrelated and interrelated activities that make entries into entry" in the ISO 9001: 2000 Quality Management System standard. In order for processes to be successfully managed and improved, all processes belonging to the activity areas of the organization must be defined. This means that the process owner has defined, a flow diagram has been drawn, borders and other operations have been shown, and a measurement set has been defined to describe the measurement system. Every process is aimed at; Meeting customer needs and expectations directly and accurately. When activities and related resources are managed as a process, the targeted outcome is achieved more effectively. At the same time, the process approach is an approach that supports the creation of a large picture of the process of creating processes, the determination of the relationships between these processes, and the continuous improvement of processes. For this reason, while the system is being regulated, the identification and documentation of operational processes, which are the core business of the institution, and the processes supporting these processes should be supported as simple, understandable, understandable expressions. Following the identification of the processes, realistic and measurable performance measurement criteria should be developed to improve these processes (Demir, 2000)

Change management and integration is an important issue for companies. This importance is increasing in the defense sector in the management of change in the industry. In this study, change management started to work on a firm operating in the defense sector, from design to outsourcing and assembly line, to increase the efficiency of monitoring and continuous improvement. .

Factors Affecting Process Management

Changes in the current production process may be necessary for external and internal reasons (Yüzbaşıoğlu, 2004) These internal and external causes are presented in Table 1.

Table 1. Different causes

External causes	Internal Actions
Globalization	Goal and Policy Changes (Future Preparation)
Democratization	Disruptions in Financial Indicators
Developments in Information Technology	Short Life of Product Life
Increasing Competition	Classical Bulky Organizations
Political Change	Increased Employees' Expectations
Economic Change	Decline in Product / Service Quality
Increase and Change in Customer Expectations	Increase in Customer Complaints
Developments in Production / Service Technologies	Decreasing Production / Service Efficiency And Efficiency
	Informal Groupings

The methods that are used when the process is documented are;
1. Process map - workflow diagram: involves determining the interrelated processes (activities) of the process.
2. Process ID card - description table: contains process information.

Process Map

A process map is a diagram that enables a process to be easily understood and a process visualized. The process map shows the identified activities and decision points in the process. According to the organizational targets determined in this way, decisions can be taken such as which phases should be changed, which phases should be supported and which steps should be abandoned. (Firuzan, 2012)

There are two types of flow process maps.

- ✓ ¬ Relationship map
- ✓ ¬ Cross-functional process map
- ✓ The relationship map shows the basic input-output customer-supplier relationships among the functions involved in the process. The relationship map can be prepared at every level in the organization. Analyzing the relationships leads to a more detailed evaluation of the work to be developed. The cross-functional process map shows the work done to transform certain inputs into the desired output, followed by the order of the functions, and allows the process to be visualized by adhering to the flow. That is, the reasons for creating a process map are;

- Understand how interactions between production and action are necessary for production,
- The process of reducing quality, slowing disorders / problems to be seen,
- To see what activities add value to output / product,
- Determination of the necessary processes for change,
- Developing functional teams between processes and actions and improving processes.

While the process map is being created, it can be used by process customers, suppliers, and questionnaires, which are referred to as process map creation guides for collecting data from functions in the process. (Zerun who, 2014)

Process Mapping Process

The steps of preparing the map are as follows,

- ✓ Understanding of the concept of process,
- ✓ Determination of basic processes,
- ✓ Creation of teams for the creation of the process map,
- ✓ Reexamination of team processes and existing processes,
- ✓ Deficiencies, problems, loss of time, repetitions must be presented in existing processes.

Process maps include the following,
1. Each process / action phase,
2. Inputs and outputs of stages,
3. Decisions to be taken at each stage,
4. The individuals who will carry out the actions and transactions,
5. It includes the time required for each stage.

(Modarress, 2005, Monden, 1995)

Process Identification Card

Process ID cards are created separately for the respective operations. The sample ID card for the purchasing process is given in Table 2.

Table 2. Purchasing process identification form

PURCHASE PROCESS ID FORM	
PROCESS NAME	he process of buying
PROCESS CODE	SATA-001
BOTTOM PROCESSES / CONNECTION	
PROCESS	No
	The goods and services requested are the best
BACKGROUND	price and on time.
OWNER	Purchasing manager
OFFICER	Purchasing Chief
PROCESS STEPS	Purchasing Manager, Purchasing Manager, Purchasing Specialist
RESOURCES	Related documents, tools, purchase software
PROCESS INPUT	Purchase Request Form
CONTROL MANAGEMENT	K1: Comparison of demand form and order form (Purchasing specialist, signature on each receipt, form) K2: Procurement with the supplier terms in the procedure
PERFORMANCE CRITERIA	P1: Ratio of rejected product P2: On-time delivery rate
PERFORMANCE MEASUREMENT MANAGEMENT PERIOD	P1: Number of rejected purchases / Total number of orders P2: On-time delivery / Total number of orders
PROCESS IN THE INTERACTION (INPUT / OUTPUT)	Production Planning Process, Administrative Affairs Process (Purchasing Lead) Storage Process (Buying Product), Accounting Process (Product Fee) Production Planning Process, Administrative Affairs Process (Purchasing Lead) Storage Process (Buying Product), Accounting Process (Product Fee) (Client-Cargo)
DOCUMENT	Procurement Procedure
PERFORMANCE MEASUREMENT RESPONSIBLE PERSONNEL	Purchasing specialist

Method

There are many different reasons and solutions for problems in the system. Thus, problems with higher probability are examined in certain categories. As a result of this classification, Pareto analysis was used to focus on the essential point to be examined.

PARETO Diagram According to Disciplines

When the disciplines arising in the armored vehicle and causing the problems to be solved are examined, the values are as seen in Table 3. The diagram is shown in Figure 2.

Table 3. PARETO by Disciplines

DISCIPLINE	NUMBER	CUMULATIVE TOTAL	CUMULATIVE PERCENTAGE
Assembly	1310	1310	62,77%
Machining	236	1546	74,08%
QA	216	1762	84,43%
Software	128	1890	90,56%
Welding, Paint, Assembly	79	1969	94,35%
Welding	73	2042	97,84%
Paint	16	2058	98,61%
Quality	16	2074	99,38%
Assembly / Machining	12	2086	99,95%
Welding/Paint,/Assembly	1	2087	100,00%

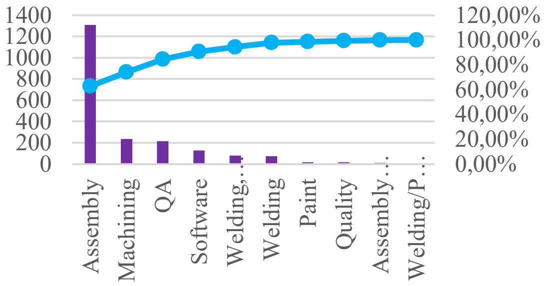


Figure 2. Pareto diagram

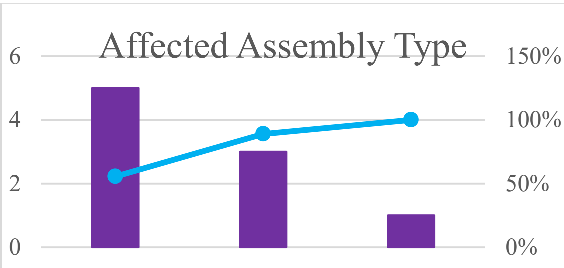
When Table 1 is examined, it is most responsible for the 'INSTALLATION' section with 62.77% of the errors in the vehicle. The second order is 'MACHINE PROCESSING'.

Time As A Review

One of the greatest benefits of trying to improve processes is to save money. It is necessary to get rid of the time that does not create added value. On the basis of this, 3-year data were processed temporally. Based on the date of opening and closing work orders, 10 longest work orders have been determined. Pareto analysis was performed on these work orders and the results are shown in Figure 3

Table 4. Longest 10 jobs

Order Number	Elapsed Time to Close Order (Day Based)	Close Code	DISPOSITION
MLZ00085	878	Auto Close	Shop Floor2
MLZ00086	878	Auto Close	Shop Floor2
MLZ00093	873	Auto Close	Retrofit
MLZ00117	857	Auto Close	Retrofit
MLZ00136	824	Auto Close	Shop Floor2
MLZ01072	766	Auto Close	Retrofit
MLZ00651	750	Auto Close	Retrofit
MLZ00098	737	Auto Close	Retrofit
MLZ01321	736	Auto Close	Piece Part



DISPOSITION	NUMBERI	KUMÜLATIF SUM	KUMULATIF PERSENTAGE
Retrofit	5	5	56%
Shop Floor2	3	8	89%
Piece Part	1	9	100%

Figure 3. PARETO diagram for the longest super 10 work order

As a result of our inability to review, the two longest-running jobs were selected. The longest period of 3 years is seen as MLZ00085 work orders for 878 days. This work has been thoroughly investigated by order processes. Their process maps have been reviewed and process cards have been created.

Conclusion and Discussion

According to the system review, there are many reasons for the long completion times of the products. Many of these reasons are attributed to mounting and documentation errors and expectations in Malaysia. The solution proposal focused primarily on operations in Malaysia, but no clear information on sanctions was obtained. In addition, proposals have been made within the company in Ankara.

- An expert should be appointed to analyze the system. (The number of job orders placed has been increased.)
- Gant diagram is available and drawn for the new situation.
- A plan has been established considering the delivery dates.

In order to determine the benefit of the expert appointment, the expiry periods for the production of the products are calculated and presented for the case before and after the appointment of the expert

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- Sistemi analiz etmek için bir uzman atanmalıdır. (Açılan iş sipariş sayıları artmıştır.)
- Gant diyagramı mevcut ve yeni durum için çizilmiştir.
- Teslim tarihleri dikkate alınarak bir plan oluşturulmuştur.

Uzman atanmanın getirdiği faydayı belirlemek için ürünlerin imalatı için harcana ort süreler hesaplanıp uzman atanması öncesi ve sonrası durum için sunulmuştur.

Before the Assignment	281.27
After the expert has been appointed	171.56

According to this review, an engineer earns about 61% time-saving in assigning jobs as an expert.
The MLZ00085 and MLZ00086 work orders examined were 878 days. Average time for shop floor2 354 Day. The height of the barrel is 248%.

It is imperative that the timely access to the required documents is made compulsory. And it should be checked continuously.

Result

The orders received by a defense company for the last two years and the completion times of these orders have been examined. Significant delays in delivery have been observed. For this reason, production processes were examined, process maps were extracted, process identity conditions were created. It has been proposed to remove unincorporated employees from the workplace. It was emphasized that the entire production process should be constantly monitored and improved.

References

Demir, F. O. & Yalçın K. (2000): "Customer Relationship Management: CRM." Review of Social, Economic and Business Studies 7.8 293-308.

Firuzan, A. R., Ümit K. & Atakan G. (2012), "Six Sigma Methodology and One in the Automotive Sector" Practice. "Journal of Yasar University 25.7): 4176-4188.

Modarress, B., Ansari, A. and Lockwood, D.L. (2005), & quot; Kaizen Costing for Lean Manufacturing: ACase Study & quot ;, International Journal of Production Research, 43 (9), 1751-1760.

Monden, Y. (1995), Cost Reduction Systems: Target Costing and Kaizen Costing, Portland, Oregon,Productivity Press.

Yüzbaşıoğlu, N. (2004), "Strategic Costs in Strategic Management and Planning in BusinessManagement and Instruments ", Selçuk University Journal of Social Sciences Institute, 12, 387-410.

Zerenler, M. And Karaboğa, K., (2014), "Errors in Providing Customer SatisfactionA Production-FocusedPerspective on Prevention: Poka-Yoke Systems. "Selçuk University Social Science Institute Review (2014): 263-275.

The Impacts of Gambling on Social Life and Academic Success of Students in Higher Education

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Abstract: Gambling can be defines as betting money on the outcome of a game, contest, or event. Throughout history, gambling has gone through various changes and entered our lives in different ways. The gambling phenomenon in Turkey has expanded to become a growing mainstream occurrence with ever increasing accessibility and acceptance among young people and adults. The majority of gamblers range from young adults to the elderly persons. Student populations in higher education setting generally do not identify themselves as having a problem with gambling. Although gambling perceived as a dangerous habit in the society, current studies are lacking about the impact of gambling on academic achievement and social life. Due to the increasing rate of gambling, particularly online gambling, and the higher rate of disordered gambling on university campuses, higher education administrators may want to consider developing policies and procedures that consider these impacts, thereby addressing the challenges that they present. Therefore, the purpose of this quantitative survey design study was to investigate the impact of gambling activities on academic achievement and social life of higher education students. This research is a descriptive study (relational-screening model). The sampling universe of the study was chosen from students studying in higher education institutions in Turkey. The analysis of data showed that there is a negative and low-level relationship between the academic achievement of students and gambling addiction scores. Furthermore, there is a significant difference between the dependency scores of the students who had the hobby and the dependency scores of the students who did not have the hobby. According to the results of the analysis, it can be said that the gambling addiction is more in the individuals who do not have the hobby.

Keywords: Gambling, Online gambling, Addiction, Higher education, Social life

Bahis Oyunlarının Üniversite Öğrencilerinin Sosyal Hayatı ve Akademik Başarısına Etkisi

Özet: Kumar ya da bahis oyunları bir oyun ya da yarışma sonucunda ortaya para koyarak kazanma ya da kaybetme şeklinde tanımlanabilir. Tarih boyunca bahis oyunları değişime uğramış ve karşımıza farklı formatlarda çıkmıştır. Kumar yetişkinler ve gençler arasında giderek erişimi kolaylaşan ve yaygınlaşan bir oldu haline gelmiştir. Kumar oynayanların çoğunluğu gençler ve yaşlılardan oluşmaktadır. Üniversitelerde okuyan gençlerin çoğu kumar oynama davranışını problem olarak görmemektedir. Toplumda kumar tehlikeli bir alışkanlık olarak bilinse de kumar oynamanın toplumsal ve akademik başarıya etkisi konusunda yeterli çalışmalar bulunmamaktadır. Gençler arasında giderek artan oranda kumar oynama özellikle çevrimiçi kumar oynama durumunun gözlemlenmesi, üniversite yöneticilerinin bu konuda yeni yönetmelikler ve politikalar geliştirmesi konusunda düşünmeye sevk etmektedir. Bu araştırmanın amacı kumar aktivitelerinin üniversite öğrencilerinin akademik başarılarına ve sosyal hayatlarına etkisini incelemektir. Bu çalışmada çalışma da ilişkisel tarama modeli kullanılmıştır. Örnekleme üniversite de okuyan öğrencilerden seçilmiştir. Verilerin analizi sonucu, kumar alışkanlığı ile akademik başarı arasında düşük sevide bir ilişki bulunmuştur. Ayrıca Hobiye sahip olmayan öğrencilerin kumar bağımlılık skorları ile bir hobi ile meşgul olan öğrencilerin kumar bağımlılık skorları arasında önemli bir fark bulunmuştur. Dolayısı ile hobisi olmayan üniversite öğrencilerinin kumar bağımlısı olma ihtimalleri daha yüksektir.

Anahtar Kelimeler: Şans oyunları, Online şans oyunları, Bağımlılık, Yüksek öğretim, Sosyal hayat

Şans Oyunları

Emek vermeden, kısa yoldan kazanç sağlama tarih boyunca insanların ilgisini çekmiştir. Kumar, birçok ülkede medya ve devlet onayıyla ya da yasa dışı olarak oynanmaktadır. Türkiye'de de milli piyango, kazı kazan, spor-toto, sayısal loto, iddia ve at yarışları gibi çeşitli oyunlar mevcuttur. Bunun dışında yasa dışı olarak bahis oyunlarına aracılık eden birçok internet sitesi bulunmaktadır. İnternetin yaygınlaşması ile birlikte bahis oyunları oynama artış göstermektedir. Büyük Larousse Ansiklopedisinde kumar, ortaya para, mal vb. konularak oynanan şans oyunu; olumlu sonuç vermesi kuşkulu olmasına karşın her şeyi göze alarak girişilen iş; para karşılığı oyun oynamak" şeklinde tanımlanmaktadır (Okur, 2011). Türk Ceza Kanununun uygulamasında ise kumar, kazanç amacıyla icra edilen ve kar ve zararın talihe bağlı olduğu oyunlar şeklinde ifade edilmektedir (Altıparmak, 2018).

Tarihte devletin gelir kaynağı olarak ilk kez kumar düzenlemesi 16. yy'de Kraliçe I. Elizabeth zamanında olmuştur (Altıparmak, 2018). Tarihsel süreç içinde kumar toplumsal özellik taşırken aynı zamanda araç olarak çeşitlenmiştir. Bazı ülkelerde yasallaşması ile birlikte önceden erişkin erkeklere özgü olduğu düşünülen kumar sorunları, kadınlarda ve gençlerde de daha sık görülmeye başlanan bir alışkanlık halini almıştır. Fakat ereklerde kumar oynama oranı kadınlara göre daha fazladır (Lostutter et al, 1976).

Okur'a (2011) göre kumar türlerine göre ikiye ayırılmaktadır. Bunlar yasal kumar ve yasadışı kumardır. Yasal kumar; devletin kontrolü altında ve bizzat devlet tarafından organize edilen kumar türüdür. Bunlar; İddia, Sayısal Loto, Spor Toto, At Yarışı, On Numara, Milli Piyango gibi kumar türleridir ve Milli Piyango İdaresi Genel Müdürlüğü, Spor Toto Genel Müdürlüğü gibi örgütlenmiş kurumlar tarafından kurumsal olarak faaliyet göstermektedirler. Yasadışı kumarın en önemli ayağını ise, internet ortamındaki e-kumar oluşturmaktadır (Atkinson et al 2012). Türkiye'deki mevcut kanuna göre kumarhane açmak yasaktır. Fakat kahvehanelerde, kulüp ve dernek adı altında da yasadışı kumar faaliyetleri gözlenmektedir (Okur, 2011). Kumar, hem yasal hem de yasadışı olarak hızla yaygınlaşmakta ve dev bir eğlence sektörü haline dönüşmüştür (Kaya 2001).

Kumar tarih boyunca şekil değiştirerek hayatiyetini sürdürmüştür. Bu değişimin ürünlerinden bir tanesi de bahis oyunlarıdır. Özellikle medyanın gücü ve internet kullanımın yaygınlaşması bu değişime öncülük etmiştir. Spor olaylarını kitlelere aktarma işlevini yerine getiren spor medyası; televizyon, gazete, internet ve radyo üzerinden yaptığı yayınlarla geniş kitleleri etkisi altına almaktadır (Özsoy et al, 2014). Medyanın kumar oyunlarının yaygınlaşmasında rolü büyüktür (Real, 2003).

Son yıllarda bahis oynama yaşının oldukça düştüğü ve bahis oyunu oynamada artış olduğu gözlemlenmektedir (Özsoy et al, 2014). Bu yaşın ortaöğretim hatta ilköğretime kadar düştüğü iddia edilmektedir. Öğrencilerin bu alışkanlığı nasıl kazandığı, en önemlisi de 18 yasından küçük bireylere İddia gibi şans oyunlarının oynatılması yönetmeliklerle yasaklanmışken bahis kuponlarının nasıl yatırıldığı sorusu, ilgili yasa ve yönetmelikleri uygulamadaki uygulamada ki sorunları ortaya koymaktadır. Bazı bahis oyunlarının internet üzerinden oynanabilir olması da 18 yaşından küçükler için ayrı bir risk oluşturmaktadır (Özsoy et al, 2014).

Bu oyunlar bağımlılık haline geldiğinde, bireyleri çeşitli yönlerden belirtiler göstermektedir. (Amerikan Psikiyatri Birliği, 1995) bu belirtileri şu şekilde listelemiştir.

Zihin meşguliyeti: Kişinin aklında sürekli kumar oynama davranışlarının olması.

Tolerans: Kişi istediği heyecanı sağlayabilmek için giderek artan miktarlarda parayla kumar oynaması.

Kaçış :Kişinin sorunlarından kaçması veya kendisini rahatsız edici duygulardan uzaklaşması için kumar oynaması.

Pesine düşme: Kişinin para kaybettikten sonra kaybettiklerini kazanmak için tekrar kumar oynaması. Kaybettiklerinin peşine düşmesi patolojik kumar bağımlılığının en önemli belirtilerinden biridir.

Yalan söyleme: Kişinin kumar alışkanlığının seviyesini gizlemek için aile üyelerine, danışmana ve diğer kişilere yalan söylemesi.

Yasa dışı eylemler: Kişinin kumar alışkanlığını finanse edebilmesi için yasal olmayan islere girişmesi.

Zarar görmüş önemli ilişkiler: Kişinin kumar oynama davranışı yüzünden ilişkilerini, mesleğini ve eğitimsel olanaklarını tehlikeye atması veya kaybetmesi.

Bailout: Kişinin kumar sonucunda yasadığı mali sıkıntılardan kurtulması için çevresindekilere güvenmesi.

Kontrol kaybı: Kişinin kumar alışkanlığını kaybetmesi kontrol edebilmesi ya da kesebilmesi için tekrar eden başarısız denemelerde bulunması.

Amerikan Psikiyatri Birliği'ne (1995) göre bu belirtilerin beş ve fazlasının kişide bulunması bağımlılığa, üç ve ya dördünün olması alışkanlığa, bir iki tane olması ise risk grubuna işaret etmektedir.

Kumar bağımlılığının pek çok nedenleri vardır. Davranışçı teorisyenler kumarı pekiştirme aracılığıyla öğrenilmiş bir davranış olarak tanımlarken, bilişsel kuramcılar kumar oynama davranışında oluşmasında ve sürdürülmesinde bilişsel çarpıtmaların önemi üzerinde dururken, psikanalisttik kuramcılar kumar oynama davranışını anal dönem özellikleriyle veya fallik dönemin karmaşasıyla açıklamaya çalışırlar (Özsoy et al, 2014). Bütün bunların yanı sıra bireylerin yalnızlık durumları, sosyal çevreleri gibi değişkenler de bu bağımlılığı etkilemektedir (Aksoy, 2011).

Bahis oyunları başta hoşça vakit geçirme, eğlence ve dinlenme aracı olarak tercih edilse de zamanla bağımlılık halini almaktadır (Eadington, 1976). Bu durum özellikle gençleri olumsuz olarak etkileyebilir. Bu çalışmanın amacı bahis oyunlarının üniversite gençlerinin sosyal hayatına ve akademik başarılarına etkisini araştırmaktır.

Yöntem

Araştırma Modeli

Birbirini etkileyebilecek iki farklı durum arasındaki ilişkilerin çeşitli değişkenler açısından incelendiği araştırmalar ilişkisel tarama modelindedir (Gençer, 2002). Bu araştırmada da öğretmenlerin üniversite öğrencilerinin çeşitli demografik özellikleri ile patolojik kumar bağımlılığı düzeyi arasındaki ilişkileri inceleneceğinden, çalışmada ilişkisel tarama modeli kullanılmıştır.

Çalışma Grubu

Çalışmanın evrenini Süleyman Demirel Üniversite'sinde öğrenim gören öğrenciler oluşturmaktadır. Çalışmanın örneklemini ise Süleyman Demirel Üniversitesi bünyesinde çeşitli fakülte ve bölümlerde öğrenim gören 70 adet öğrenci oluşturmaktadır. Bu öğrencilerin 17 'si kadın (%24,3), 53'ü ise (%75,7) erkektir. Çalışmaya katılan öğrencilerin yaşları 19 ile 35 arasında değişmekte olup yaş ortalamaları 22,64 standart sapmaları ise 2,34 şeklindedir.

Veri Toplama Araçları

Kişisel Bilgi Formu

Bu form araştırmaya katılan öğrencilerin cinsiyet, yaş, eğitim aldıkları bölüm, akademik başarı puanları, aile-ekonomik gelir düzeyleri ve hobiler gibi sosyal hayatlarına ilişkin bilgiler edinebilmek amacıyla hazırlanmıştır.

South-OaksKomar Tarama Testi

Öğrencilerin kumar bağımlılık düzeylerini belirlemek amacıyla South Oaks Kumar Tarama Testi/SOKTT kullanılmıştır (Henry et al 1993). SOKTT patolojik kumarbazların belirlenmesinde yaygın olarak kullanılan bir testtir. SOKTT'nin puanlamaya dâhil edilen 20 maddesinden 17'sinin kültürümüzde patolojik kumar sorunu olanları olmayanlardan ayırt ettiği görülürken, çalışmadığı belirlenen üç madde ölçekten çıkartılarak yerine kültürümüze özgü iki yeni madde eklenmiştir. Yapılan analizler sonucunda SOKTT'nin Türkçe Formu kesme noktası 8 puan olan, 19 maddelik bir ölçek halini almıştır. On dokuz maddelik SOKTT'nin iç-tutarlık katsayısı Cronbach alfa= .8772 ve test-tekrar-test korelasyonu r= .95 olarak bulunmuştur. Bu bulguların ışığında SOKTT'nin ülkemizde patolojik kumarbazların belirlenmesinde güvenilir ve geçerli bir ölçüm aracı olarak kullanılabileceğine karar verilmiştir.

Verilerin Analizi

Bu değişkenler ile bağımlılık düzeyleri arasında ilişkinin belirlenmesi için çeşitli istatiksel analizler gerçekleştirilmiştir. Öğrencilerin aile gelir düzeyleri ile bağımlılık düzeyleri arasındaki ilişkinin incelenmesinde Pearson korelasyon analizi kullanılmıştır. Benzer şekilde öğrencilerin akademik başarı puanları ile bağımlılık düzeyleri arasındaki ilişkinin incelenmesinde de Pearson korelasyon analizi kullanılmıştır. Öğrencilerin cinsiyet ve hobiye sahip olma durumları ile bağımlılık puanlarının kıyaslanmasında ise bağımsız örneklem t testi kullanılmıştır. Analizlere ilişkin sonuçlara bulgular başlığı altında yer verilmiştir.

Sonuçlar ve Tartışma

Kumar Bağımlılığına İlişkin Bulgular

Çalışmaya katılan öğrencilerin patolojik kumar bağımlılığı düzeylerini cinsiyete göre kıyaslamak için bağımsız örneklemler t testi uygulanmıştır. Bağımlı örneklemler t testi sonuçları Tablo 1 'de sunulmuştur.

Tablo 1. Cinsiyet ile kumar bağımlılığı t testi sonuçları

Değişken	Cinsiyet	N	$\overline{X}$	Ss	t
Bağımlılık	Kız	17	0,70	0,84	-6,530**
	Erkek	53	3,37	2,57	

Tablo 1'de de görüldüğü üzere çalışmaya katılan öğrencilerin patolojik kumar bağımlılığı düzeylerini cinsiyete göre kıyaslamak için bağımsız örneklemler t testi uygulanmıştır. Buna göre erkekler (X=3,37, Ss=2,57) ile kadınların (X=0,70, Ss=0,84) anlamlı derecede farklı bağımlılık düzeyinde olduğu görülmüştür [t(226)=- 6,530, p<0,01].

Çalışmaya katılan üniversite öğrencilerinin akademik başarıları ile kumar bağımlılığı puanları arasındaki ilişkiyi tespit etmek için Pearson korelasyon katsayısı hesaplanmıştır. Gerçekleştirilen korelasyon analizinin sonuçları Tablo 2'de sunulmuştur.

Tablo 2. Akademik başarı ile kumar bağımlılık puanı arasındaki korelasyon analizi sonuçları

Değişken	Akademik Başarı	Bağımlılık puanı
Akademik Başarı	1	-0,240*
Bağımlılık puanı	-0,240*	1

Değişkenler arasındaki ilişkiyi incelemek için Pearson korelasyon katsayıları hesaplanmış ve Tablo 2'de sunulmuştur. Öğrencilerin akademik başarıları ile kumar bağımlılık punalrı arasında negatif ve düşük düzeyde anlamlı bir ilişki görülmektedir (r= -0,240, p<0,05).
Çalışmaya katılan üniversite öğrencilerinin aile-ekonomik gelir düzeyleri ile bağımlılık düzeyleri arasındaki ilişkiyi tespit etmek için Pearson korelasyon katsayısı hesaplanmıştır. Korelasyon analizinin sonuçları Tablo x'de sunulmuştur.

Tablo 3. Aile-gelir düzeyi ile kumar bağımlılık puanı arasındaki korelasyon analizi sonuçları

Değişken	Aile-gelir düzeyi	Bağımlılık puanı
Aile-gelir düzeyi	1	,120
Bağımlılık puanı	,120	1

Değişkenler arasındaki ilişkiyi incelemek için Pearson korelasyon katsayıları hesaplanmış ve Tablo 3'de sunulmuştur. Öğrencilerin aile-ekonomik gelir düzeyleri ile bağımlılık düzeyleri arasındaki herhangi bir düzeyde ve yönde ilişki bulunamamıştır (r=,120, p>0,05).

Bunların yanı sıra, çalışmaya katılan öğrencilerin patolojik kumar bağımlılığı düzeylerini hobileri olup olmaması durumuna göre kıyaslamak için bağımsız örneklemler t testi uygulanmıştır. Bağımlı örneklemler t testi sonuçları Tablo 3 'de sunulmuştur.

Tablo 3. Hobiye sahip olma durumu ile kumar bağımlılığı t testi sonuçları

Değişken	Hobi	N	$\overline{X}$	Ss	t
Bağımlılık	Var	45	1,73	1,73	5,126**
	Yok	25	4,52	2,81	

*p<0,05
**p<0,01

Tablo 3'de de görüldüğü üzere çalışmaya katılan öğrencilerin patolojik kumar bağımlılığı düzeylerini hobiye sahip olma durumlarına göre kıyaslamak için bağımsız örneklemler t testi uygulanmıştır. Buna göre hobiye sahip olan öğrencilerin bağımlılık puanları ile (X=1,73, Ss=1,73) hobiye sahip olmayan öğrencilerin bağımlılık puanları (X=4,52, Ss=2,81) arasında anlamlı derecede fark olduğu görülmüştür [t(226)=5,126, p<0,01]. Analiz sonuçlarına göre hobiye sahip olmayan bireylerde daha çok kumar bağımlılığı olduğu görülmüştür.

Sonuçlar

Bu çalışma kapsamında üniversite öğrencilerinin çeşitli demografik özellikleri ile kumar bağımlılık seviyeleri arasındaki ilişkiler incelenmiştir. Bu kapsamda araştırmaya katılan öğrencilerin cinsiyet, yaş, eğitim aldıkları bölüm, akademik başarı puanları, aile-ekonomik gelir düzeyleri ve hobiler gibi sosyal hayatlarına ilişkin bilgiler toplanmıştır. Bu değişkenler ile bağımlılık düzeyleri arasında ilişkinin belirlenmesi için çeşitli istatiksel analizler gerçekleştirilmiştir. Öğrencilerin aile gelir düzeyleri ile bağımlılık düzeyleri arasındaki ilişkinin incelenmesinde Pearson korelasyon analizi kullanılmıştır. Benzer şekilde öğrencilerin akademik başarı puanları ile bağımlılık düzeyleri arasındaki ilişkinin incelenmesinde de Pearson korelasyon analizi kullanılmıştır. Öğrencilerin cinsiyet ve hobiye sahip olma durumları ile bağımlılık puanlarının kıyaslanmasında ise bağımsız örneklem t testi kullanılmıştır. Çalışmaya katılan öğrencilerin patolojik kumar bağımlılığı düzeylerini cinsiyete göre kıyaslamak için bağımsız örneklemler t testi uygulanmıştır. Bağımlı örneklemler t testi sonuçlarına göre erkekler ile kadınların anlamlı derecede farklı bağımlılık düzeyinde olduğu görülmüştür. Analiz sonuçlarına göre kadınların bağımlılık puanları erkeklerden düşük olduğu gözlemlenmiştir.

Çalışmaya katılan üniversite öğrencilerinin akademik başarıları ile kumar bağımlılığı puanları arasındaki ilişkiyi incelemk için Pearson korelasyon katsayısı kullanılmıştır. Gerçekleştirilen korelasyon analizinin sonucunda öğrencilerin akademik başarıları ile kumar bağımlılık puanları arasında negatif ve düşük düzeyde anlamlı bir ilişki olduğu gözlemlenmiştir.

Çalışmaya katılan üniversite öğrencilerinin aile-ekonomik gelir düzeyleri ile bağımlılık düzeyleri arasındaki ilişkiyi tespit etmek için Pearson korelasyon katsayısı hesaplanmıştır. Korelasyon analizinin sonuçlarına göre öğrencilerin aile-ekonomik gelir düzeyleri ile bağımlılık düzeyleri arasındaki herhangi bir düzeyde ve yönde ilişki bulunamamıştır.

Ayrıca çalışmaya katılan öğrencilerin patolojik kumar bağımlılığı düzeylerini hobileri olup olmaması durumuna göre kıyaslamak için bağımsız örneklemler t testi uygulanmıştır. Bağımlı örneklemler t testi sonuçlarına göre hobiye sahip olan öğrencilerin bağımlılık puanları ile hobiye sahip olmayan öğrencilerin bağımlılık puanları arasında anlamlı derecede fark olduğu görülmüştür. Analiz sonuçlarına göre hobiye sahip olmayan bireylerin, kumar bağımlısı olma ihtimali bir hobiye sahip olan öğrencilere göre daha yüksek olduğu görülmektedir.

Öneriler

Araştırma bulguları göz önüne alındığında ailelerin çocuklarını kumar gibi bahis oyunlarının tehlikelerinden uzat tutmaları için onlara bir hobi edinmeleri konusunda yardımcı olmaları gerektiği tavsiye edilebilir. Ayrıca bahis oyunları alışkanlığı olan öğrencilerin akademik anlamda başarılı olma ihtimalleri diğer öğrencilere göre daha düşük olduğu söylenebilir.

Not

Verilerin toplanmasında katkılarından dolayı Taha Atıcı’ ya teşekkür ederim.

Kaynaklar

Altıparmak, C.(2008). ‘Kumar Kabahati’ Terazi Hukuk Dergisi, S. 19, Ankara, Seçkin Yayınevi, s. 133-140.

Aksoy, A. (2011). Kumar Bağımlılığının Belirtileri.Retrieved from http://www.bagimlilik.info.tr/kumar_bagimliliginin_belirtileri.html

Amerikan Psikiyatri Birliği (1995). Bozuklukların Tanısal ve Sayısal El Kitabı, Dördüncü Baskı (DSMIV). Amerikan Psikiyatri Birliği Washington DC, 1994’ de çeviren Köroğlu E, Hekimler Yayın Birliği; Ankara, 843-847.

Eadington, W. R. (1976). Gambling and Society: Interdisciplinary Studies on the Subject of Gambling. Springfield, IL: Charles C. Thomas.Ferris, J. & Wynne, H. (2001,February). The Canadian Problem Gambling Index: Final Report. Ottawa, ON:Canadian Centre on Substance Abuse. Retrieved January 16, 2016, from http://www.cclat.ca/2003%20and%20earlier%20CCSA%20Documents/ccsa-008805-2001.pd

Gençer, A. (2002). Öğretmenlerin İş Doyumu ile Mesleki Tükenmişlik Düzeyleri Arasındaki İlişki. Yayımlanmamış yüksek lisans tezi. Osmangazi Üniversitesi Sosyal Bilimler Enstitüsü, Eskişehir.

Henry R. Lesieur & Sheila B. Blume (1993). Revising the South Oaks Gambling Screen in different settings. Journal of Gambling Studies, 9, 213-223.

Kaya, B. (2001).. Kumar hastalık mı? Endüstri mi? 8. Ulusal Psikiyatri Kongresi Bilimsel Çalışmaları, 23-31 Mayıs Lefkoşa, 119-125

Real, M. (2003). Mediasport: Technology and the Commodification of Post Modern Sport, Mediasport, L.Wenner (Ed.). New York: Routledge.

Okur, A. (2011). Kumar (Şans oyunları) Raporu. Retrieved on 02.11.2016. Available Online at: http://www.muharrembalci.com/hukukdunyasi/raporlar/334.pdf

Özsoy, S., Gelen, N. K., Kardaş, N. T., Tabuk, M. E., Görün, L., & Aysun, A. F. A. T. (2014). Lise ve üniversite öğrencilerinin spor medyasını izleme ve bahis oyunu oynama alışkanlıkları. Erciyes İletişim Dergisi,3(3).

Lesieur, H.R.. Blume, S.B. (1987). South Oaks Gambling Screen (SOGS): A new instrument for the identification of pathological gamblers. American Journal of Psychiatry, 144, 1184–1188.

Lostutter, T. W., Lewis, M. A., Cronce, J. M., Neighbors, C., & Larimer, M. E. (2012). The use of protective behaviors in relation to gambling among college s tudents. Journal of Gambling Studies, 1 -20. doi:10.1007/s10899 - 012-9343-8

A Design of Mobile Application for Students with Dyscalculia

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Abstract: In this study, a mobile application is designed for the students with discalculia which is a learning disability including all types of mathematical problems. Students with dyscalculia have problems in understanding the meaning of numbers, mathematical terms and applying mathematical principles in solving problems. In this study, we designed a mobile application which includes lessons about four arithmetical operations namely addition, subtraction, multiplication and division for such students to make learning these mathematical subjects more easy and practical. It is clear that if basic mathematics subjects are not understood clearly, students with dyscalculia will have difficulty in understanding more advanced mathematical applications. As the evolvements in mobile technologies occur, the usage of mobile devices increases day by day. Especially for school age children, it is thought that using mobile applications in teaching will be more effective and enjoyable. With this aim, a mobile application which includes user friendly interfaces is designed to teach students with discalculia subjects namely addition, subtraction, multiplication and division without making them getting bored.

Keywords: Dyscalculia, Mobile application

Dyscalculia Öğrencileri Için Mobil Uygulama Tasarımı

Özet: Bu çalışmada, her türlü matematiksel problemi içeren bir öğrenme yetersizliği olan discalculia öğrencileri için bir mobil uygulama tasarlanmıştır. Discalculia öğrencileri, sayıların anlamını, matematik terimlerini anlamayı ve problem çözmede matematiksel prensipleri uygulamada problem yaşarlar. Bu çalışmada, bu matematiksel konuların öğrenilmesini daha kolay ve pratik hale getirmek için dört aritmetik işlem, toplama, çıkarma, çarpma ve bölme derslerini içeren bir mobil uygulama tasarladık. Temel matematik konularının açık bir şekilde anlaşılmaması durumunda, discalculia olan öğrencilerin daha gelişmiş matematiksel uygulamaları anlamada zorlanacağı açıktır. Mobil teknolojilerdeki gelişmeler ortaya çıktıkça, mobil cihazların kullanımı her geçen gün artmaktadır. Özellikle okul çağındaki çocuklar için, öğretimdeki mobil uygulamaların daha etkili ve eğlenceli olacağı düşünülmektedir. Bu amaçla, kullanıcı dostu arayüzleri içeren bir mobil uygulama, öğrencilere diskülsiyon konularını öğretme, çıkarma, çarpma ve bölme işlemlerini sıkılmadan yapmaları için tasarlanmıştır.

Anahtar Kelimeler: Dyscalculia, Mobil uygulama

Giriş

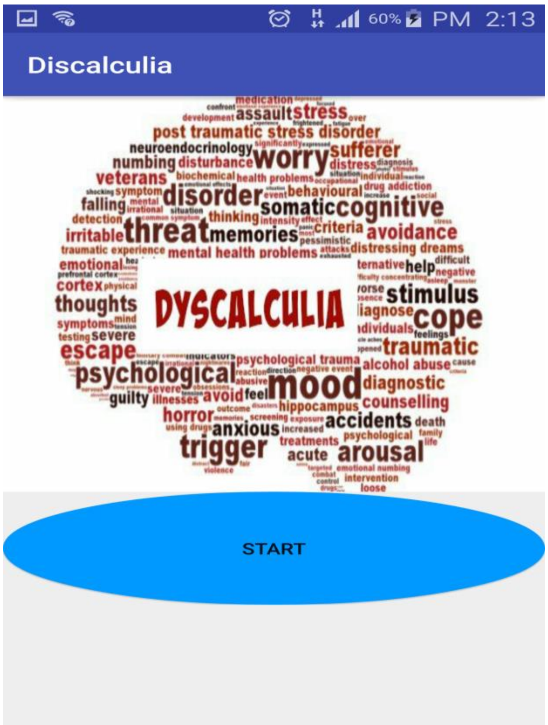
Matematik öğrenme güçlüğü anlamına gelen Diskalkuli, zihinsel bir problem olmayıp,sayı ve sembolleri kavrama, matematiksel işlemleri gerçekleştirme ve ilişkilendirmede güçlük yaşatan özel öğrenme bozukluğu olarak tanımlanabilmektedir [1]. Matematik öğrenme bozukluğu genellikle çocuk yaşlarda ortaya çıkmaktadır. Özellikle de toplama, çıkarma, çarpma ve bölme gibi temel dört işlemi yapmakta zorluk yaşama, matematiksel problemlerin çözümünde işlem sırasını kurgulayamama, çarpım tablosunu ezberleyememe, sembolleri birbirine karıştırma, çok basit hesaplama hataları yapma, geometrik şekilleri öğrenememe, mantıksal oyunlarda sıklıkla hata yapma gibi sorunlar Diskalkulik öğrencilerde genel olarak ortak karşılaşılan problemlerdir [1,2].

Matematik öğrenme güçlüğü çeken öğrencilerin zamanında yapılan müdahaleler ve destekler ile bu problemi en aza indirgemeleri mümkündür. Özellikle de öğrencilere eğitici matematiksel oyunların oynatılmasının, dikkat ve hafıza egzersizlerinin yaptırılmasının, aritmetik zeka oyunlarının oynatılmasının oldukça etkili olacağı düşünülmektedir. Bu amaçla geliştirilen eğitsel ve eğitici oyunlar da mevcuttur [3].

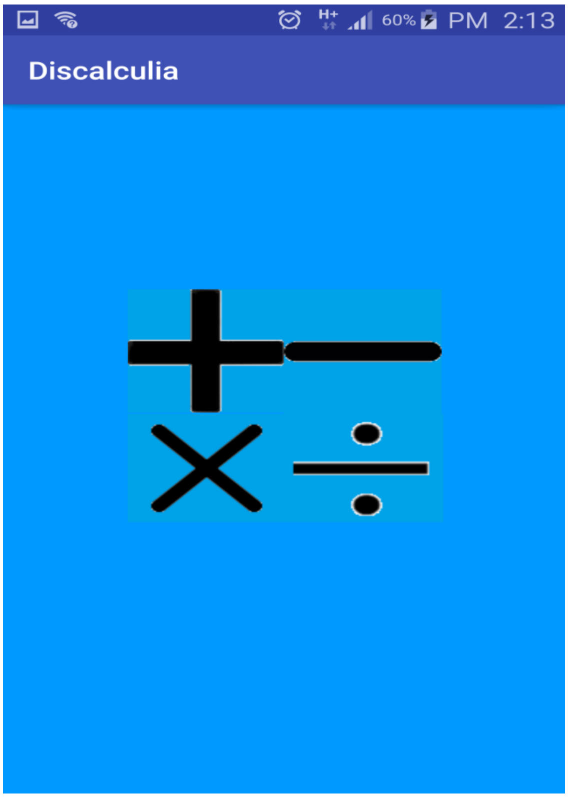
Mobil teknolojilerdeki gelişmeler, her geçen gün mobil uygulamalardaki artış, öğrencilerin mobil uygulamalar karşısında çokça vakit geçirmesi, bu çalışmada eğitici amaçlı mobil uygulama geliştirilmesinde motive edici etken olmuştur. Özellikle de matematik öğrenme güçlüğü çeken öğrenciler için geliştirilen uygulamada öğrencilerin toplama, çıkarma, çarpma ve bölme işlemlerini mobil uygulama arayüzleri ve şekillerle görselleştirilerek öğrencilerin daha kolay öğrenmesinin sağlanması hedeflenmiştir. Çalışmanın devamında geliştirilen mobil uygulamanın arayüzleri detayları ile açıklanmış olup, sonuç bölümünde gelecek çalışmalardan bahsedilmiştir.

Matematik Öğrenme Güçlüğü olan (Diskalkuli) Öğrenciler için Mobil Uygulama Tasarımı

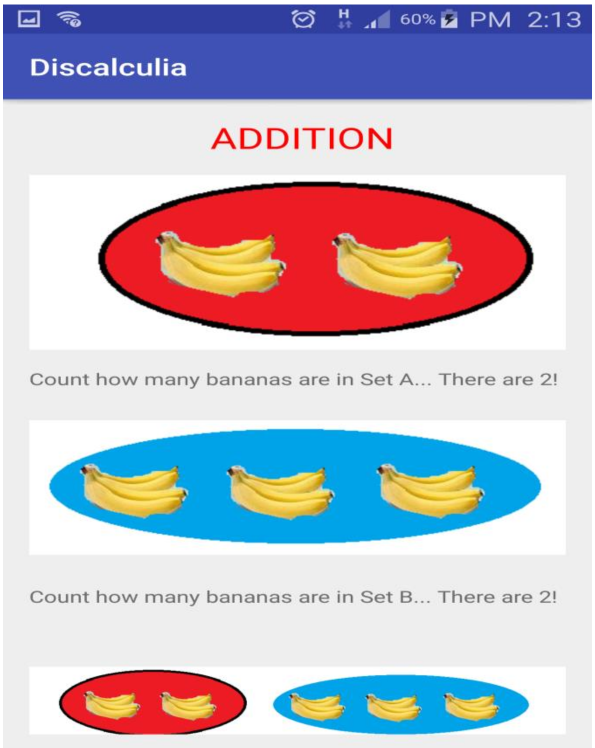
Bu çalışmada, matematik öğrenme güçlüğü olan öğrencilerin, temel işlemler olan toplama, çıkarma, çarpma ve bölme işlemlerini kavrayabilmeleri için görsel ekranlar içeren bir mobil uygulama tasarımı gerçekleştirilmiştir. Bu uygulama sayesinde, diskalkuli öğrencileri dört işlemin nasıl yapıldığını şekillerle ve daha eğlenerek öğrenme fırsatı bulabileceklerdir.



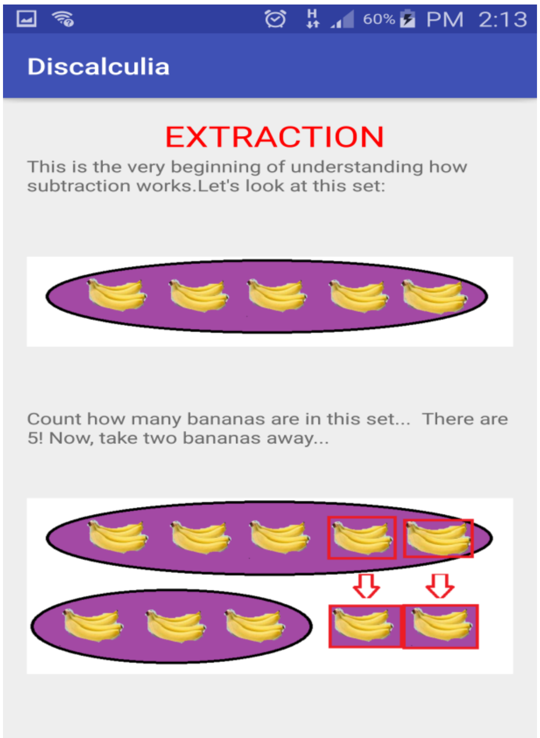
(a)



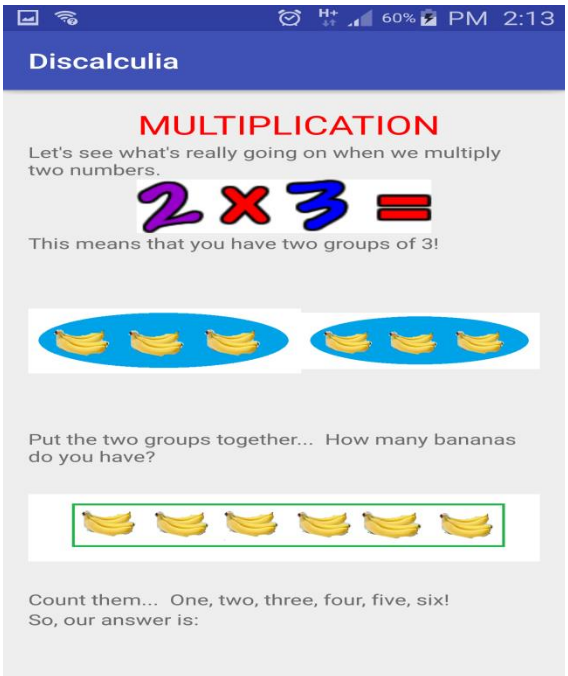
(b)



(c)



(d)



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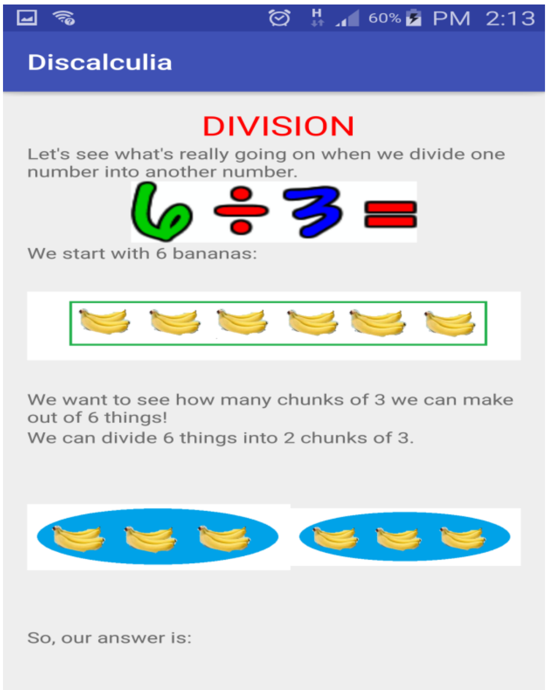

(f)

Şekil 1. Geliştirilen sistemin görsel arayüzleri

Şekil 1'de geliştirilen mobil uygulamanın arayüzleri sunulmuştur. Matematik öğrenme güçlüğü çeken öğrenci, mobil cihazına bu uygulamayı indirdiğinde öncelikle Şekil 1.a'daki ekranla karşılaşacak olup başla düğmesine bastığında kendisine toplama, çıkarma, çarpma ve bölme seçeneklerinin sunulduğu Şekil 1.b'deki ekran ile karşılaşacaktır. Öğrencinin toplama işlemini seçmesi durumunda Şekil 1.c'deki ekran, çıkarma işlemini seçmesi durumunda Şekil 1.d'deki ekran, çarpma işlemini seçmesi durumunda Şekil 1.e'deki ekran ve son olarak bölme işlemini seçmesi durumunda Şekil 1.f'deki ekran açılacaktır. Bu ekranların her birinde seçilen dört işlem, şekiller kullanılarak görsel olarak açıklanmaktadır. Uygulamanın gerçekleştiriminde Java Android Studio kullanılmıştır.

Sonuç

Bu çalışmanın gerçekleştirimi ile matematik öğrenme güçlüğü çeken öğrencilerin matematikteki dört işlemi mobil cihazlarına indirecekleri uygulama ile görsel olarak ve eğlenerek öğrenmeleri hedeflenmiştir. Mobil teknolojilerdeki gelişmeler, mobil uygulamaların artmasına ve bireylerin mobil cihazlar ile daha çok vakit geçirmelerini sağlamıştır. Özellikle de dört işlemin öğretildiği yaşlardaki öğrencilerin mobil cihazlar karşısında geçirdiği vakit düşünüldüğünde, mobil cihazların sadece eğlence amaçlı değil öğrenme amaçlı da etkin bir şekilde kullanılabileceği düşüncesini oluşturmuştur. Bu çalışmada tasarımı sunulan uygulamanın, gelecek çalışmalarda matematik öğrenme güçlüğü çeken öğrenciler üzerindeki etkisi incelenecek olup, SPSS istatistik programı kullanılarak analizlerin gerçekleştirilmesi planlanmaktadır.

Kaynakça

https://www.mentalup.net/blog/matematik-ogrenme-guclugu-diskalkuli
http://akademidisleksi.com/uzman/diskalkuli-matematiksel-ogrenme-guclugu-diskalkuli-egitimi/
https://www.mentalup.net/egitsel-ve-egitici-oyunlar

The Impact of Technology on The Understanding of The World of Science

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Abstract: It is possible to say that the science that emerged in the direction of the researches which are done as a result of the curiosity of the human being passes through many stages in the process which is continuing up to the day-to-day. There are many factors that need to be learned, understood and embodied by the individual and society. At the beginning of these elements are the technological tools and equipment used in the period. Learning to classify and use these technological tools and equipment by the individual or the community will facilitate the evaluation of individual facts and events in terms of individual or collective scientific terms. In this study, it is foreseen to evaluate the findings obtained from studies conducted by researchers analyzing the technological structure used in order to make the world of science more understandable, based on the 20th and 21st centuries. when studies on the subject in the working process are examined, many differences on the basis of findings reveal the importance of using technology in the scientific world. the most important consequence that should be perceived clearly in the result of the study is that the technological tools used to understand the world of science are close to the level of meaning of the individual.

Keywords: Science, Technology, Appliance, Equipment

Bilim Dünyasının Anlamlandırılmasında Teknolojinin Etkisi

Özet: İnsanoğlunun merakı sonucu yapılan araştırmalar doğrultusunda ortaya çıkan bilimin günümüze kadar devam eden süreçte birçok aşamadan geçtiğini söylemek mümkündür. Bu aşamaların birey ve toplum tarafından öğrenilip, anlamlandırılıp, somutlaştırılması için birçok unsura ihtiyaç vardır. Bu unsurların başında da dönemde kullanılan teknolojik araç ve gereçler gelmektedir. Bu teknolojik araç ve gereçlerin birey ya da toplum tarafından tasnifi yapılıp kullanımının öğrenilmesi bilim dünyasını anlamlandırmada bireye ya da topluma bilimsel olgu ve olayları değerlendirme konusunda kolaylık sağlayacaktır. Yapılan bu çalışma da 20 ve 21. yüzyıllar temele alınarak bilim dünyasını daha anlaşılır hale getirmek için kullanılan teknolojik yapıyı analiz eden araştırmacıların yaptığı çalışmalardan elde ettikleri bulguları literatür destekli açıklayarak değerlendirmeyi öngörmektedir. Çalışma sürecinde konuyla ilgili yapılan çalışmalar incelendiğinde bulgu bazında birçok farklılığın ortaya çıkması bilim dünyasında teknolojinin kullanımının önemini ortaya çıkarmaktadır. Çalışma sonucunda net bir şekilde algılanması gereken en önemli sonucun bilim dünyasını anlamak için kullanılan teknolojik araç gereçlerin bireyin anlamlandırma düzeyine yakın olması yani bireyin kullanım seviyesine uygun olmasıdır.

Anahtar Kelimeler: Bilim, Teknoloji, Araç, Gereç

Giriş

İnsan var olduğu günden bu yana, bir yandan evrende olup bitenleri anlama, tanıma, onun sırlarını çözme, öte yandan doğayı kontrol altına alarak daha rahat ve güvenli bir yaşam sürdürme isteğini duymuştur. Bu istek doğrultusunda sürdürülen sistemli çabalar sonucu, bilim oluşmuştur. Bilim teknolojik uygulamalarıyla hem yaşam koşullarımızı değiştirmekte hem de düşünmemizi biçimlendirerek dünya görüşümüzü etkilemektedir. Gerek bireylerin gerekse toplumların yaşantılarını önemli ölçüde etkileyen bilim, aynı zamanda, toplumsal gelişme ve çağdaşlaşmanın temel ölçütü olarak kabul edilmektedir (Yaşar, 1998).

Teknolojilerin kullanımının günlük yaşamımızdaki katkıları ve sınırlılıkları halen tartışılmasına karşın, teknoloji uygun koşullarda ve başarılı olarak kullanıldığı takdirde insan yaşamını daha kolay hale getirmekte, rahatlatmakta ve doyumlu kılmaktadır (Akkoyunlu, 1996).

Araştırmanın Amacı

Bu çalışma 20. ve 21. yüzyıllar temelinde bilim dünyasını daha anlaşılır hale getirmek için kullanılan teknolojik yapıyı analiz eden araştırmacıların yaptığı çalışmalardan elde ettikleri bulguları literatür destekli açıklayarak değerlendirmeyi öngörmektedir.

Yöntem

Araştırmanın Modeli

Bu araştırmada genel tarama modeli kullanılmıştır. Genel tarama modelleri çok sayıda elemandan oluşan bir evrende, evren hakkında genel bir yargıya varmak amacıyla evrenin tümü ya da ondan alınacak bir grup örnek ya da örneklem üzerinde yapılan tarama düzenlemeleridir (Karataş, 2007).

Bilim nedir?

Bilim, evrenin veya olayların bir bölümünü konu olarak seçen, deneye dayanan yöntemler ve gerçeklikten yararlanarak sonuç çıkarmaya çalışan düzenli bilgi, ilim demektir (TDK, 2011). Bilim kelimesinin özel bir bilgi türü, diğer bir deyişle çeşitli bilgi türleri arasında kendine has özellikleri olan bir bilgi çeşididir (Ural, 2000). Bilim, evren üzerine bilim sistemi ile toplanmış bilgiler biçiminde tanımlanabilir (Say, 2007). İnsan etkinliğini en yararlı alanı olan bilimin İyonya"da Küçük Asya"nın (Günümüz Türkiye"si) batı ucunda ve bu kıyıların açıklarındaki adalarda ortaya çıktığı düşünülür. Erwin Schrödinger"e göre bilimin burada ortaya çıkmasının üç önemli nedeni vardır. Birincisi bu bölge genelde özgür düşünceye karşı olan güçlü devletlerden birine ait değildi. İkincisi İyonyalılar denizci bir halktı ve sağlam ticaret bağları vardı. Üçüncüsü bu bölge din adamlarının denetiminde değildi (Watson, 2014).

Teknoloji nedir?

Bir sanayi dalı ile ilgili yapım yöntemlerini, kullanılan araç, gereç ve aletleri, bunların kullanım biçimlerini kapsayan uygulama bilgisine teknoloji denir (TDK, 2018). Yaşadığımız dünya, teknolojik bir dünyadır. Teknolojik dünyayı karakterize eden hayatımızın her alanında mevcut nesneler çokluğudur. Çokluk, tüketimin olduğu her alanda mevcuttur ve bu tüketim nesneleri, tüketim ilişkilerinde bir takım değişiklikler yaratmıştır. Teknolojik verilerle donanmış tüketim nesnelerinin klasik üretim ilişkileri ile meydana gelmiş nesnelerden farklı bir dünya yaratmıştır (Çötok, 2017).Bu literatür taraması birikerek ilerleyen teknolojik gelişmelerin 20. yüzyılda da artarak devam eden ve bugüne kadar biriken hafızasını ele almıştır.

20. Yüzyıldan Günümüze Teknolojik Gelişmelerin Konu Edindiği Bilimsel Çalışmalar

2 Temmuz 1900 yılında Almanlar ilk defa benzin motorunu balona uyguladılar. Alman Kont Ferdinand von Zeppelin güdümlü balonculuğa yeni bir boyut kazandırdı. 1898"de patentini aldığı bu balon türü sonradan yapımcısının ismiyle "zeplin" olarak anıldı (Çelik, 2004). Bu konuyla ilgili Chant 2000 yılında 1900"den 1937"ye kadar Alman hava gemileri tarihi adlı çalışmayı paylaşmıştır. Vömel"in de 1908"de Kont Zeppelin"in hayatı hakkında makalesi bulunmaktadır.

12 Aralık 1903 yılında Orville ve Wilbur Wright kardeşler 12 beygir gücünde bir motorla donatılmış uçağa benzer bir aleti 12 saniye havada tutmayı ve 40 metre ileriye konmasını başardılar (Arıoğlu, 1999). Konuyla ilgili kendilerinin 1906"da paylaştıkları çalışma mevcuttur. McFarland, Marvin W. ve Arthur G. Renstrom da 1950 yılındaki çalışmasında Wright Kardeşlerin yazılarını araştırmışlardır.

1912"de Amerikalı mucit Charles Franklin Kettering marş motorunu icat etti ve elle krankı döndürerek motora ilk hareketi vermeye gerek kalmadı (Sayın & Yüksel, 2011). Bu konuyla ilgili Derrenberger 1937"de yayınlanan çalışması Kettering ile ilgili bilgi vermektedir. Lesile"in 1979"daki eseri de marş motoru hakkında bilim dünyasını aydınlatmaktadır.

1927"de Alan Grosland"ın yönettiği Caz Şarkıcısı (The Jazz Singer) filminde ilk defa ses ve müzik aynı anda kullanılmıştır. Öncesinde 1926"da Don Juan adlı filmde sadece müzik kullanılmıştır, bu filmde konuşma yoktur (Sözen,2003). Konuyla ilgili Zweier"in sessiz filmlerin tarih olduğunu anlatan çalışması bulunmaktadır.

1929"da Edwin Hubble, bulutsuların hızlarıyla uzaklıkları arasındaki ilişkiyi tanımlamaya yarayacak gözlemler yaptı (Sencer,1998). Konuyla ilgili kendisinin eserleri bulunmakla beraber Christianson"ın da Edwin Hubble: Mariner Of The Nebulae adlı çalışması bulunmaktadır.

1930"da Estonya asıllı Alman gözlükçü Bernhard Voldemar Schmidt özel bir düzeltici fotoğraf camı icat etti. Bu küresel aynanın odak noktasının yakınına yerleştirilen karmaşık şekilli küçük camdan bir cisimdi. Düzeltici cam, ışık dalgalarını çarpılmayı ortadan kaldıracak şekilde büküyordu, böylece geniş alanlar bile düzgün bir biçimde büyütülebiliyordu. Bu fotoğraf camının yerleştirildiği alete Schmidt teleskopu denildi (Asimov, 2006). Konuyla ilgili Henry C. King" The History of The Telescope adlı kitapta detaylı bilgi verilmektedir.

1930"da daha önce yapılan hesap makinelerinden daha iyi olan bilgisayar çalışmaları yapıldı. Belli bir bilgi yığınını saklama çalışmaları yapıldı. Elektronik olan sayısal bilgisayarlar geliştirildi (İşman, 2001). Shurkin"in 1984"te yayınladığı kitabı Engines of the Mind: A History of the Computer bilgisayarların tarihsel gelişimini anlatan kaynaklardandır.

1932"de Ernst Ruska ilk elektron mikroskobunu yaptı (Gökdoğan, Demir, Topdemir, Unat, Kalaycıoğulları, Emlü, 2001). Konuyla ilgili detaylı bilgi Ruska"nın 1987"de The Development Of The Electron Microscope And Of Electron Microscopy adlı çalışmasında mevcuttur.

1935"te İskoçyalı fizikçi Sir Robert Alexander Watson-Watt tarafından radar keşfedilmiştir. Almanlar, Japonlar, Amerikalılar ve İngilizler kilometrelerce uzaktan yaklaşan uçaklarla ilgili uyarı vermek için İskoç fizikçi Watson-Watt tarafından 1935 yılında keşfedilen radarı kullanmışlardır (Demir, 2014). Radar ile ilgili birçok çalışma bulunmaktadır. Günümüze en yakın Brown"un 1999"da yayınladığı bir çalışma mevcuttur.

1939"da havacılık mühendisi Rus asıllı Amerikalı İgor Sikorsky"nin 2. Dünya Savaşının başında ilk helikopteri icat etmesiyle kullanımına başlandı. Savaş sonrası birçok ülke özellikle Sovyet Rusya uçak ve helikopter yapımını geliştirdi (Doğan, 2013). Helikopterlerin tarihi gelişimi hakkında birçok eser bulunmaktadır. 2000 yılında Leishman"ın A History Of Helicopter Flight adlı çalışmasında detaylı bilgi bulunmaktadır.

1957"de Sovyet Sosyalist Cumhuriyetler Birliği"nin Sputnik uydusunu uzaya yerleştirmesi sonucu, bilgi evrimi evrensel boyutlara ulaşmış, yerküreyi bütünleştirmiştir. Bu gelişmeden sonra Uzay Çağı başlamıştır. (Ünal, 2009). Bu konuyla ilgili Gordon, Ford, Rosenberg ve Koppel"in çalışması bulunmaktadır.

1946"da Amerikalı J.Presper Erchert ve John W. Mauchly yüksek işlem hızına sahip tam elektronik ilk sayısal bilgisayarı geliştirdiler. 17500 civarında elektron tüpü, 1500 röle, 70000 direnç ve 10000 kondansatörden oluşmuş 30 ton ağırlığındaki bu dev makine, on haneli beş bin sayıyı bir saniye içinde toplayabiliyordu (Tekeli, Kahya, Dosay, Demir, Topdemir, Unat & Aydın, 2001). Bu konuyla ilgili 2014"te Metropolis, Howlett ve Gian-Carlo Rota editörlüğünde yayınlanmış kitap mevcuttur.

1958"de Amerikalı fizikçi Chester F. Carlson kuru toz elektrik yükü ve ışık kullanan bir kopyalama yöntemi bulmaya çalıştı. Islak hiçbir şey kullanılmadığından bulduğu işleme elektrostatik yöntemle kopya çıkarma adı verildi, ayrıca ışık da kullanıldığından fotokopi denilmektedir. Bu konuyla ilgili Hovy, Hermjakob, Ravichandran"in 2002"de hazırladıkları çalışma mevcuttur.

1960"ta Bolembergen"in bulduğu üç düzey ilkesini kullanarak maser benzeri aygıt Maiman tarafından geliştirildi. Bu şekilde üretilen uyumlu ışığın yayılma eğilimi çok az oluyor ve o kadar küçük bir noktada toplanıyordu ki bu düzeyde güneş yüzeyinden çok daha yüksek sıcaklıklara ulaşılabiliyordu. Aygıta ilk olarak optik maser adı verildi fakat uyarılmış ışınım yayımı ile ışık güçlendirme olarak tanımlanabileceğinden deyimin ilk harfleri alındı ve lazer denildi. bu konuyla ilgili 1983"te Smith ve Wherrett"in yayınladıkları çalışma mevcuttur.

1972"de lazer diskler kullanıma sunuldu. burada bir ses lazer demeti tarafından alınıyor ve bu demet sesi düz diskler üzerinde mikroskobik çukurların içine kaydedilen bilgiye çeviriyordu. Daha sonra bunlar başka lazer demetleri tarafından toplanıyordu. 1975"te transistörler ilk kez geliştirildikten sonra gittikçe daha küçük, ucuz ve güvenilir yapılmış olduğu halde daha da küçüldüler ve üzerlerindeki devreler o kadar sıkıcı bir şekilde monte edildiler ki artık bunlara mikroçip denilebilirdi. 1981 „ e gelindiğinde ilk uzay mekiği tasarlandı. Amaç yörüngeye oturtmak ve sonra dünyaya geri getirtmekti. 1982"de IBM lazer yazıcıları piyasaya sürdü. Bunlar sessiz çalışıyor ve saniyede 30 satır basabiliyordu (Asimov, 2006).

1973"te Ethernet (yerel bilgisayar ağı), Robert Metcalfe ve Xerox tarafından icat edildi. konuyla ilgili Metcalfe ve Boggs"un beraber yayınladığı çalışmaları mevcuttur. 1981"de ilk IBM PC üretildi. Konuyla ilgili Baldwin, Martin ve Pilsworth"ün 1995"te yayınladığı çalışma mevcuttur.

2000‟de Prof. Dr. Tuncay Uluğ, kulak ve kafa tabanı cerrahisi için tasarladığı mikro cerrahi aletleriyle adını tüm dünyaya duyurdu. İstanbul Üniversitesi İstanbul Tıp Fakültesi Öğretim Üyesi Uluğ‟un 1999‟da tasarladığı, 2000 yılında da bir Türk firmasınca üretimini gerçekleştirdiği bu aletler, şimdi dünyaca ünlü Alman Storz firması tarafından „Ulug Double Sided Ear Microsurgery Instruments‟ (Uluğ Çift Taraflı Kulak Mikro Cerrahi Aletleri) adıyla dünya piyasalarına sunuldu. Konuyla ilgili kendisinin 2002 ve 2006 yıllarında iki ayrı baskısı yapılan Temporal Kemik Cerrahisi adlı eseri bulunmaktadır.

2007‟de Yrd. Doç. Dr. Hilmi Volkan Demir ile öğrencileri Sedat Nizamoğlu, Tuncel Özel ve Emre Sarı, Edison‟un icat ettiği ampule alternatif nanoteknoloji ürünü ışık kaynağı üretti. Kendisinin bu konuyla ilgili çalışmaları literatürde mevcuttur.

Değerlendirme

Literatürde yer alan 20. yüzyıldan günümüze doğru üretilen teknolojik aletler ve bu aletlerle ilgili çalışmalar özetlenmeye çalışılmıştır. Türkiye‟de bu konuda yapılan çalışmalar çok sınırlıdır. Keşif ve icatların insan hayatındaki tesirinin ve sosyal tepkisinin son çağlara has bir olay olmaktan uzak olduğu açık ve kesindir. Eski Taş, Yeni Taş, Tunç ve Demir devirlerinin her birinin kendi hususi aletleri vardır. Bu devirler teknik ilerlemeler ile açılmıştır ve her birinde, modern sanayinin başladığı 17. asırdan beri olduğu gibi, süratli nüfus artışı görülmektedir. Ateşin kullanılmaya başlaması, hayvan ve nebat ehlileştirilmeleri, madenlerin keşfi ve kullanılması ve tekerleğin icadı gibi yenilikleri hepsinin insan hayatı üzerinde büyük gelişmelere sebep olduğu açıktır (Sayılı, 1990). Bu çalışma teknolojik aletlerin üretiminin konu edindiği çalışmalara ulaşma açısından önemlidir.

Kaynakça

Akkoyunlu,B.(1996).Bilgisayar Okur Yazarlığı Yeterlilikleri İle Mevcut Ders Programlarının Kaynaştırılmasının Öğrenci Başarı Ve Tutumlarına Etkisi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *12*(12), s. 127-134

Arıoğlu, E. (1999). Bilim-Teknoloji ve Eğitim, 2000'li Yıllarda Uzay, Havacılık Ve Savunma Teknolojilerinin Öncelikleri Sempozyumu Bildirileri kitabı içinde (ss. 1-7). İstanbul: Hava Harp Okulu

Asimov, I. (2006). Bilim ve Buluşlar Tarihi, (çev. Elif Topçogil) 1. Baskı, Ankara: İmge Kitabevi Yayınları

Çelik, A. (2004). II. Meşrutiyet Döneminde Türk Hava Kuvvetleri, Yayınlanmış Yüksek Lisans Tezi Selçuk Üniversitesi Sosyal Bilimler Enstitüsü, Konya

Çötok, T. (2017). Teknoloji Toplumunda Kaygı, *Sosyal ve Kültürel Araştırmalar Dergisi,* 3(5), s. 209-222

Demir, M. (2014). Radyo Frekanslı Kimlik Tanımlama (Rfıd) Sistemi İle Tren Konum Tespiti, Yayınlanmış Yüksek Lisans Tezi, Yıldız Teknik Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul

Doğan, M. (2013). Bilim ve Teknoloji Tarihi, 2. Baskı, Ankara: Anı Yayıncılık

Gökdoğan, M., Demir, R., Topdemir, H., Unat, Y., Kalaycıoğulları, İ.& Emlü, Y. (2001). Bilim Tarihi Kılavuzu, 1. Basım, Ankara: Nobel Yayın Dağıtım

İşman, A. (2001). Bilgisayar ve eğitim. *Sakarya Üniversitesi Eğitim Fakültesi Dergisi*, (2) s. 1-34

Karataş, Z. (2007). Sosyal Bilimlerde Araştırma Yöntemleri (Karşılaştırmalı Araştırma Teknikleri Doktora Dersi Ödevi Kitap Özeti), Selçuk Üniversitesi, Sağlık Bilimleri Enstitüsü, Konya

Say, A. (2007). Bilim ve Pazarlama, 1.Baskı, İstanbul: Beta Basım Yayın Dağıtım A.Ş.

Sayılı, A. (1990). Hayatta En Hakiki Mürşit İlimdir, 1. Basım, Ankara: Metropol Yayıncılık

Sayın, A.A. & Yüksel İ. (2011). Elektrikli Renault Fluence Aracı, Lityum-İyon Bataryasının Modellenmesi Ve Batarya Yönetimi. *Engineer & the Machinery Magazine*, (615), s. 75-82

Sencer, M. (1998). Bilim Tarihinde Dönüm Noktaları, 1. Baskı, İstanbul: Say Dağıtım Yayıncılık

Sözen, M. (2003). Sinemada Ses Kullanımı, 1. Baskı, Ankara: Detay Yayıncılık

TDK(2018).http://www.tdk.gov.tr/index.php?option=com_gts&arama=gts&guid=TDK.GTS.5addbcb8d0c4e6.54293221 adresinden 10.03.2018 tarihinde edinilmiştir.

TDK, (2011). Türkçe Sözlük, 11. Baskı, Ankara:Türk Dil Kurumu Yayınları

Tekeli, S., Kahya, E., Dosay, M., Demir, R., Topdemir, H., Unat Y. & Aydın, A. (2001). Bilim Tarihine Giriş, 3. Baskı, Ankara: Nobel Yayın Dağıtım

Ural, Ş. (2000). Bilim Tarihi, 3. Baskı, İstanbul: Çantay Kitabevi

Ünal, Y. (2009). Bilgi toplumunun tarihçesi, Tarih Okulu, S. 5 s. 123-144

Watson, P. (2014). Fikirler Tarihi, (çev. Kemal Atakay, Barış Pala, Bahar Tırnakçı, Nurettin Elhüseyni, Kaya Genç), 1. Baskı, İstanbul: Yapı Kredi Yayınları

Yaşar, Ş. (1998). Çağdaş bilim anlayışı. *Çağdaş yaşam çağdaş insan*, 154-162.

Analysis of the Educational Augmented Reality Applications in Turkey

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Abstract: It has been observed that the technology which keeps its rapid development from the 20th century to the present day is supporting the teaching of some materials in many fields, especially in education. It is thought that the increasing reality applications which are very popular recently in this developing technology will facilitate the students and instructors in the educational environment. Increased reality provides the enrichment and support of reality in the environment by embodying these knowledge and concepts in situations where individuals do not understand some information and concepts in the real environment and are confused. Increased reality visually enriches virtual and relative environments with a simple basic structure. Increased reality is an innovative technology that combines media and data such as video, animation, three-dimensional model, sound, graphics and GPS position information produced in the digital world with the real world. In this study, the level at Computer Technologies for the use of this technology in Turkey opinions of the teaching staff who work in science education are evaluated. In the study conducted, the answers of the questions in the semi-structured interview form were analyzed by using qualitative research methods' opinions of field experts and using descriptive analysis and content analysis techniques.

Keywords: Augmented reality, Technology, Practice, Learning, Education

Türkiye'de Artırılmış Gerçeklik Uygulamalarının Eğitsel Analizi

Özet: Yirminci yüzyıldan günümüze doğru hızla gelişimini sürdüren teknolojinin eğitim başta olmak üzere birçok alanda bazı materyallerle öğretimi destekleyici nitelikte olduğu gözlenmektedir. Bu gelişen teknolojiden son zamanlarda oldukça popüler olan artırılmış gerçeklik uygulamalarının eğitsel ortamlarda öğrenciler ve eğitmenlere kolaylık sağlayacağı düşünülmektedir. Artırılmış gerçeklik bireylerin gerçek ortamda bazı bilgileri ve kavramları anlamadığı ve karmaşa yaşadığı durumlarda bu bilgi ve kavramları somutlaştırarak ortamdaki gerçekliğin zenginleştirilmesini ve desteklenmesini sağlamaktadır. Artırılmış gerçeklik sanal ve görece ortamları temelde basit bir yapıyla görsel olarak zenginleştirmektedir. Artırılmış gerçeklik gerçek dünya ile dijital ortamda üretilen video, animasyon, üç boyutlu model, ses, grafik ve GPS konum bilgisi gibi medya ve verilerin birleşimini sağlayan yenilikçi bir teknolojidir. Yapılan bu çalışmada bu teknolojinin Türkiye'de kullanım düzeyine ilişkin Bilgisayar Teknolojileri Eğitimi bilim dalında görev yapan öğretim elemanlarının görüşleri değerlendirilmiştir. Yapılan çalışmada alan uzmanlarının görüşleri nitel araştırma yöntemlerinden betimsel analiz ve içerik analizi teknikleri kullanılarak yarı yapılandırılmış görüşme formundaki soruların yanıtları analiz edilmiştir.

Anahtar Kelimeler: Artırılmış gerçeklik, Teknoloji, Öğrenme, Uygulama, Eğitim

Giriş

Yaşadığımız yüzyılın teknolojik aletlere odaklı olması bu aletlerin kullanım bilgisinin mevcut olduğu öğretmenlere olan ihtiyacı arttırmaktadır. Modern cihazları ve yenilikçi teknolojileri kapsayan bilişim teknolojilerinin, eğitimi desteklemek ve zenginleştirmek amacıyla nasıl kullanılabileceği sorusu, son yıllarda eğitim ve eğitim teknolojisi alanındaki çalışmalara yön vermektedir (Somyürek, 2014).

Artırılmış gerçeklik alanında yapılan çalışmaların sayısı son yıllarda artmasına rağmen bu alanda yapılan tanım ve terimler teknolojideki gelişmelere paralel olarak değişkenlik göstermektedir. Milgram ve Kishino'nun (1994) yaptığı artırılmış gerçeklik tanımı, "gerçek dünya nesneleri yerine dijital ortam ürünlerinin kullanıldığı gerçeklik ortamıdır" en genel tanım olarak karşımıza çıkmaktadır. Artırılmış gerçeklik gerçek dünyanın sanal dünya ile gerçek zamanlı olarak bir araya geldiği ve aynı duyusal alanda kullanıcıya ulaştığı ortamlardır (Özarslan, 2011; Erbaş & Demirer, 2014). Artırılmış gerçeklikteki amaç; fiziki gerçeklik algısıyla elde edilen bilgiye sayısal bir bilgi eklemesi yapmaktır. Böylece kullanıcının algısının kuvvetlendirilerek hedef mekân, yapı ya da obje ile alakalı daha fazla bilgiye sahip olması hedeflenmektedir (Coşkun, 2017).

Hızla yayılan artırılmış gerçeklik uygulamaları hayatımızın birçok alanında karşımıza çıkmaktadır. Eğitim, askeriye, tasarım, spor, sağlık, gibi birçok alanda artırılmış gerçeklik uygulamaları kullanılmaya başlanmıştır. Pek çok araştırmaya göre artırılmış gerçeklik uygulamalarının şuan için kısıtlamaları olsa da gelecekte çok önemli bir teknoloji olacağı vurgulanmaktadır (İbili & Şahin, 2015).

Artırılmış gerçeklik, bilgisayarlar veya mobil cihazlar üzerinden görüntülenen nesnenin ya da herhangi bir şeklin, görsellere çevrilerek ekran üzerinde kullanıcıya nesnenin yansıyarak gerçekmiş gibi görüntülenmesidir. Yani bu sistem sayesinde avuçların içindeki bilgisayar veya mobil cihazın ekranı aracılığı ile gerçek hayatta orada olmayan bir nesne veya bir olay oluyor gibi görülmektedir. Artırılmış gerçeklik, basılı materyallerin veya nesnelerin dijital olarak görüntülenmesi sağlar (Çakır, Solak & Tan, 2015).

Araştırmanın Amacı

Bu araştırmanın amacı Türkiye'de artırılmış gerçeklik uygulamalarının eğitim ortamına entegre edilme sıklığını analiz etmektir. Bu yolla Bilgisayar Teknolojileri Eğitimi bilim dalında görev yapan öğretim elemanlarına şu sorular sorularak cevap aranmıştır;

- Artırılmış gerçeklik uygulamaları ülkemizde daha çok hangi alanlarda kullanılmaktadır?
- Artırılmış gerçeklik uygulamalarının öğrenme ve öğretme sürecine etkisi nedir?
- Artırılmış gerçeklik uygulamalarının eğitimde kullanımının olumsuz yönleri nelerdir?

Yöntem

Araştırmanın Modeli

Türkiye'de Artırılmış gerçeklik uygulamalarının eğitimde kullanımının araştırıldığı bu çalışmada nitel araştırma yaklaşımına dayalı yarı yapılandırılmış görüşme yöntemi kullanılmıştır. Storey (2007) nitel araştırmanın, insanların olaylara dönük öznel bakış açılarını keşfetmeyi hedeflediğini ve bu nedenle nicel araştırmadan daha üstün olduğunu belirtmektedir. Dolayısıyla nitel araştırmayı insanın, kendi sırlarını çözmek ve kendi çabasıyla biçimlendirdiği toplumsal sistemlerin derinliklerini keşfetmek üzere geliştirdiği bilgi üretme yollarından birisi olarak tanımlamak mümkündür (Özdemir, 2014). Patton (1987)'a göre araştırmacı, görüşme yöntemi kullanarak görüşme yapılan kişinin içsel dünyasına girmeye ve olayları onun perspektifinden anlamaya ve kavramaya çalışır (Türnüklü, 2000).

Çalışma Grubu

Araştırmanın çalışma grubunu Diyarbakır Dicle, Malatya İnönü ve Elazığ Fırat Üniversitesi Eğitim Fakültesi Bilgisayar Teknolojileri Eğitimi anabilim dalında akademik hayatına devam eden 15 öğretim elemanı oluşturmaktadır. Çalışma grubunun bu illerde yer alan üniversitelerde görev yapan öğretim elemanlarından seçilmesi araştırmacılara ulaşım kolaylığı ve araştırmanın güvenirliği açısından kolaylık sağladığı için çalışma grubu üyeleri bu illerden seçilmiştir. Çalışma grubu üyelerinin 12'si erkek 3'ü kadın adaylardan oluşmaktadır.

Veri Toplama Aracı

Araştırmanın kuramsal boyutu oluşturulduktan sonra artırılmış gerçeklik uygulamalarının kullanımını analiz etmek için yarı yapılandırılmış görüşme formu hazırlanmıştır. Görüşme formu hazırlanırken önce sorular belirlenmiştir. Sorular oluşturulurken kolay anlaşılabilecek sorular yazma, açık uçlu sorular sorma, odaklı sorular hazırlama, yönlendirmekten kaçınma, çok boyutlu sorular sormaktan kaçınma ve soruları mantıklı bir biçimde düzenleme gibi ilkelere (Yıldırım ve Şimşek, 2008) dikkat edilmiştir. Görüşme formunda 3 soru yer almaktadır. Görüşmelerin gerçekleştirilebilmesi için araştırmacılar, araştırma kapsamındaki her bir öğretim görevlisi ile önceden görüşme yaparak randevu almıştır. Görüşmede görüşme formunda yer alan sorular öğretim görevlisine sırasıyla sorulmuş ve bir şekilde soruları cevaplaması talep edilmiştir. Katılımcıların sorulara verdiği yanıtlar, araştırmacılar tarafından yazılı olarak kaydedilmiştir.

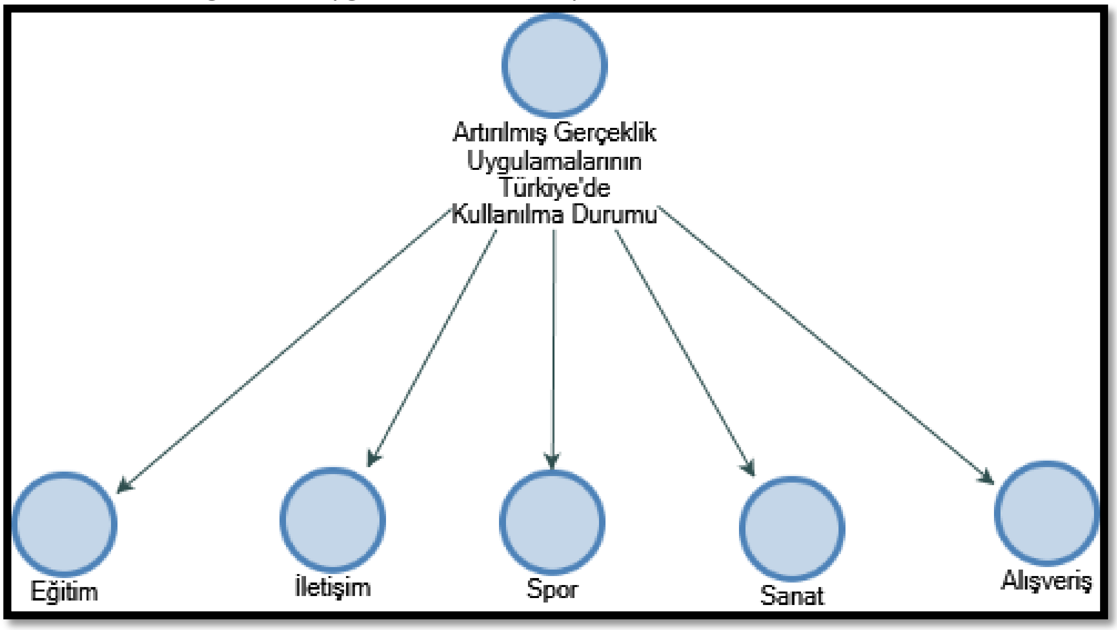
Verilerin Analizi

Araştırmada yarı yapılandırılmış görüşme formu ile ilgili çözümlemeler, nitel boyutta gerçekleştirilmiştir. Bilgisayar destekli nitel veri analizi yapılmıştır. Verilerin analizinde ve modellerin oluşturulmasında NVivo 11 programından yararlanılmıştır. Kodlamalar araştırmacıların ortak görüşleri doğrultusunda oluşturulmuştur. Bu çerçevede, katılımcıların artırılmış gerçeklik uygulamalarını değerlendirilmesine yönelik görüşleri betimsel ve içerik analizi teknikleriyle belli temalar altında gruplanarak çözümlenmeye çalışılmıştır. Araştırmanın güvenirliğini sağlamak için, araştırmada ulaşılan uzman görüşüne başvurulmuştur. Araştırmacılar ve uzmanlar tarafından öncelikle ana temalar ardından bunlara bağlı alt temalar oluşturulmuştur. Çözümlemeler sonucunda ortaya çıkan temalar aralarındaki bağları gösterir şekilde modellenmiş ve görselleştirilmiştir. Modelde yer alan ilişkileri gösteren temayı söyleyen kişi sayısı (frekansını) belirlenmiştir. Araştırmacıların ve uzmanın, temalarda yer alması gereken görüşlere ilişkin değerlendirmeleri karşılaştırılarak "görüş birliği" ve "görüş ayrılığı" sayıları tespit edilmiştir. Araştırmacı dışında iki uzmanla birlikte analizler yapılıp, Miles ve Huberman'ın (1994) formülüne göre araştırmacılar arasındaki uyum hesaplanmıştır. Bu hesaplama sonucunda, P =(83/83+1) x 100 = %92 olarak hesaplanmıştır.

Bulgular

Öğretim elemanlarının görüşleri temelinde, verilerin analizi ile elde edilen bulgular aşağıda yöneltilen sorulara ilişkin oluşan alt başlıklar altında yer almaktadır.

Artırılmış gerçeklik uygulamalarının türkiye'de kullanım alanlarına ilişkin durumu



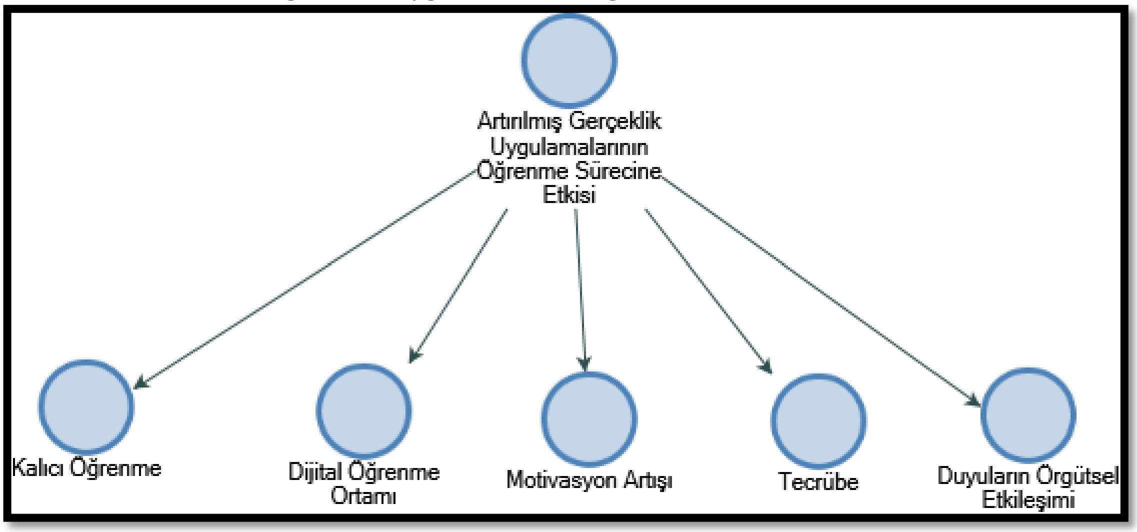
Şekil 1. Artırılmış gerçeklik uygulamalarının Türkiye'de kullanım alanları durumunun sonuçları

Araştırmada katılımcıların artırılmış gerçeklik uygulamalarının Türkiye'de kullanım alanlarına ilişkin görüşleri, yarı yapılandırılmış görüşme formunda yer alan "Artırılmış gerçeklik uygulamaları ülkemizde daha çok hangi alanlarda kullanılmaktadır?" sorusuyla alınıp değerlendirilmiştir. Katılımcıların verdiği cevaplar ışığında yukarıda oluşan sonuçlar incelendiğinde, öğretim elemanlarının çoğunluğu eğitim (f=10) temasını ön plana çıkardıklarını; geri kalan adayların ise iletişim (f=2), spor (f=1), sanat (f=1), alışveriş (f=1) temalarını ön plana çıkardıklarını şekil 1'e baktığımızda söyleyebiliriz. Katılımcıların görüşleri paralelinde artırılmış gerçeklik uygulamalarının ülkemizde kullanım alanlarının başında eğitimin geldiğini ve bunu iletişim sektörünün takip ettiğini söylemek mümkündür. Bu konuyla ilgili katılımcıların görüşleri aşağıdaki şekilde örneklendirilebilir:

"*Artırılmış gerçeklik uygulamaları ile ilgili çalışmalar Türkiye'de kendini daha çok eğitim ortamında göstermektedir. Coğrafya, tarih, fizik, geometri gibi derslerde kütüphane ve müzelerde ve daha birçok alanda kullanılabilen bu uygulamalar Türkiye'de henüz yeterince önem kazanmamış olmasına rağmen önümüzdeki yıllarda eğitime entegre edildikçe öğrenci başarısı ve motivasyonunu artırıcı olacaktır* (öğretim elemanı-eğitim)."

"*Artırılmış gerçeklik uygulamalarının ülkemizde kullanım alanları sınırlıdır. En fazla kullanılan alanın eğitim olduğunu söyleyebiliriz. Fakat bunun yanında iletişim alanında da son zamanlarda adından söz ettiren bu uygulamalar ekipman desteğiyle gelecekte dijital ortamın sağladığı fırsatlardan faydalanmamızı sağlayacaktır* (öğretim elemanı-iletişim)."

Artırılmış gerçeklik uygulamalarının öğrenme sürecine etkileri durumu



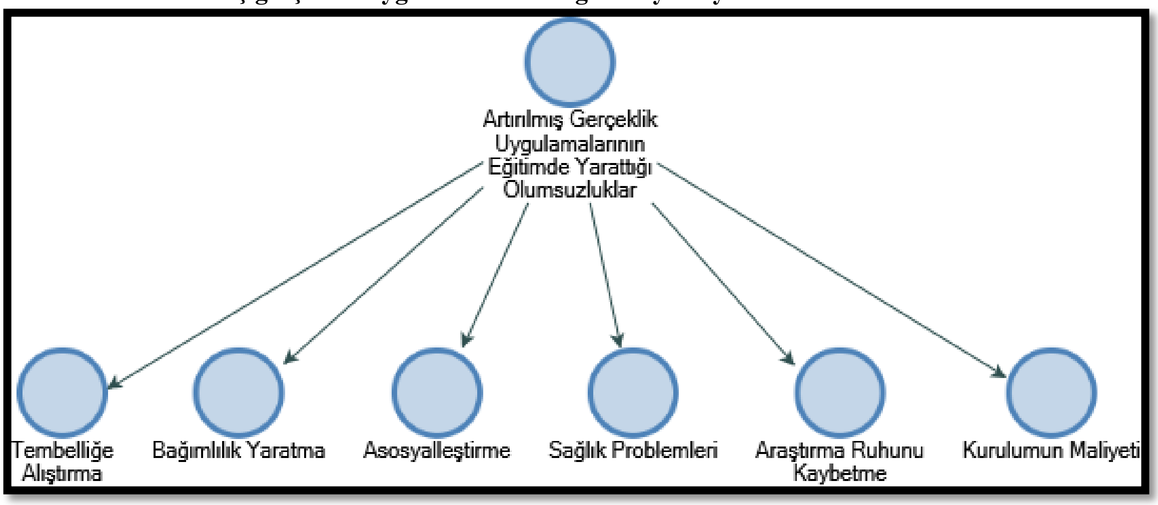
Şekil 2: artırılmış gerçeklik uygulamalarının öğrenme sürecine etkilerine ilişkin sonuçları

Araştırmada katılımcıların artırılmış gerçeklik uygulamalarının öğrenme ve öğretme sürecine etkilerine ilişkin görüşleri, yarı yapılandırılmış görüşme formunda yer alan "Artırılmış gerçeklik uygulamalarının öğrenme ve öğretme sürecine etkisi nedir?" sorusuyla alınıp değerlendirilmiştir. Katılımcıların verdiği cevaplar ışığında yukarıda oluşan sonuçlar incelendiğinde, öğretim elemanlarının çoğunluğu kalıcı öğrenme (f=6) temasını ön plana çıkardıklarını; geri kalan adayların ise dijital öğrenme ortamı (f=3), motivasyon artışı (f=3), tecrübe (f=2), duyuların örgütsel etkileşimi (f=1) temalarını ön plana çıkardıklarını şekil 2'ye baktığımızda söyleyebiliriz. Katılımcıların artırılmış gerçeklik uygulamalarının öğrenme sürecine etkisi hakkındaki görüşleri her ne kadar farklı gibi görünse de verilen bütün cevapların öğrenme öğretme sürecine birbiriyle bağlantılı olarak etki ettiğini söylemek mümkündür. Bu konuyla ilgili katılımcıların görüşleri aşağıdaki şekilde örneklendirilebilir:

"*Artırılmış gerçeklik çağımızın karakteristik özelliği olan dijital dünyayı soyut olmaktan bir miktar uzaklaştırmaktadır. Günlük yaşamımızda kullandığımız nesne ve aletlerin üstünde doğrudan eklenen ses, video, fotoğraf gibi bilgi tabakalarıyla gelişen bu teknoloji öğrenme ve öğretme ortamında özellikle çocukların dikkatini çekmektedir. Dijital ortamdan koparılamayan çocuklarımızın artırılmış gerçeklik uygulamalarıyla daha kalıcı öğrenmeler gerçekleştirebileceği aşikar* (öğretim elemanı-dijital öğrenme ortamı)."

"*Artırılmış gerçeklik uygulamaları en iyi öğrenme yöntemi olan yaparak yaşayarak öğrenme stilinin daha etkin kullanımını sağlayan bir teknolojidir. Gerçeğe yakın bir öğrenme deneyimi sunan artırılmış gerçeklik uygulamalarının öğrenme ve öğretme sürecinde kullanımı öğrenme deneyimi sağlaması, zamandan tasarruf edilmesi ve öğretimin maliyetini düşürmesi açısından fayda sağlayacaktır. Öğrencinin öğrenme deneyimin artması da kalıcı bir öğrenmeyi gerçekleştirecektir* (öğretim elemanı-kalıcı öğrenme)."

Artırılmış gerçeklik uygulamalarının eğitime yansıyan olumsuzlukları durumu



Şekil 3. Artırılmış gerçeklik uygulamalarının eğitimde yarattığı olumsuzluk durumu sonuçları

Araştırmada katılımcıların artırılmış gerçeklik uygulamalarının eğitimde yarattığı olumsuzluklara ilişkin görüşleri, yarı yapılandırılmış görüşme formunda yer alan "Artırılmış gerçeklik uygulamalarının eğitimde kullanımının olumsuz yönleri nelerdir?" sorusuyla alınıp değerlendirilmiştir. Katılımcıların verdiği cevaplar ışığında yukarıda oluşan sonuçlar incelendiğinde, öğretim elemanlarının tembelliğe alıştırma (f=4), bağımlılık yaratma (f=3), asosyalleştirme (f=3), sağlık problemleri (f=2), araştırma ruhunu kaybetme (f=2), kurulumun maliyetli oluşu (f=1) temalarını ürettiklerini şekil 2'ye baktığımızda söyleyebiliriz. Katılımcıların artırılmış gerçeklik uygulamalarının olumsuz yönleriyle ilgili görüşlerinin teknolojik aletlerin kullanımının olumsuz yönleriyle aynı olduğunu söylemek mümkündür. Bu konuyla ilgili katılımcıların görüşleri aşağıdaki şekilde örneklendirilebilir:

"*Artırılmış gerçeklik uygulamaları birçok olumlu yönlerinin dışında tembellik gibi bir olumsuzluğu da beraberinde getirir. Hazır bilgiye anında erişim öğrenciyi araştırma yapmaktan, literatür taramaktan, deney yapmaktan alıkoyar* (öğretim elemanı-tembelliğe alıştırma)."

"*Bu uygulamalar teknolojik ekipmanlarla kullanıldığı için öğrenci-öğretmen ve öğrenci-öğrenci etkileşimini azaltabilmektedir. Uygulamaların zengin içeriği ve kolay kullanımı bireysel çalışmayı destekleyeceğinden öğrencileri asosyalliğe itebilir* (öğretim elemanı-asosyalleştirme)."

"*Artırılmış gerçeklik uygulamaları doğru kullanıldığında kalıcı öğrenme gerçekleştirebilmektedir. Fakat yanlış ve aşırı kullanım sonucu bireyde sağlık sorunlarına sebebiyet verebilmektedir. Özellikle göz sağlığı açısından bakıldığında bilgisayar ekranı gibi veya diğer teknolojik aletin dijital ekranları gibi oldukça büyük görme kusurlarına yol açabileceğini düşünüyorum* (öğretim elemanı-sağlık problemleri)."

Tartışma, Sonuç ve Öneriler

Artırılmış gerçeklik uygulamalarının eğitimde kullanımının öğretim elemanlarının görüşleri ışığında analiz edildiği bu çalışmada yarı yapılandırılmış görüşme formuyla öğretim elemanlarından veriler toplanmıştır. Elde edilen veriler incelendiğinde öğretim elemanlarının bazı noktalarda benzer bazı noktalarda ise farklı görüşlere sahip oldukları gözlemlenmiştir (şekil 1, 2, 3). Geliştirilen yeni teknolojilerden biri olan artırılmış gerçeklik teknolojisi, Milgram ve Kishino'ya göre (1994) yaşadığımız dünyadaki nesneler yerine dijital objelerin kullanıldığı gerçeklik ortamları, Gonzato, Arcila ve Crespin (2008) tarafından gerçek hayattaki görüntülere eş zamanlı olarak resim, metin, ses vb. nesnelerin eklenmesiyle gerçek dünyanın artırılmış gibi hissedilmesidir (Korucu, Usta & Yavuzaslan, 2016).

Artırılmış gerçeklik uygulamalarının Türkiye'de kullanım alanlarına ilişkin bilgisayar teknolojileri eğitimi ana bilim dalında görev yapmakta olan öğretim elemanlarının görüşleri eğitim, iletişim, spor, sanat ve alışveriş temaları altında toplanmıştır. Bu uygulamaların fen ve sosyal bilimler eğitiminde kullanımının yanında mühendislik, mimarlık, reklamcılık, çeşitli sanat dalları gibi alanlarda da kendini göstermesinin olası olduğu öngörülmüştür. Lee (2012)'ye göre artırılmış gerçeklik sanal ve gerçek ortamları temelde basit bir yapıyla görsel olarak zenginleştirmektedir. Artırılmış gerçeklik, gerçek dünya ile dijital ortamda üretilen video, animasyon, 3 boyutlu model, ses, grafik ve GPS konum bilgisi gibi medya ve verilerin birleşimini sağlayan yenilikçi bir teknolojidir (Koçoğlu, 2017). Bu tanıma göre de artırılmış gerçeklik uygulamalarının kullanım alanlarının genişliği daha net anlaşılmaktadır.

Çalışmada elde edilen verilerden hareketle şu öneriler geliştirilebilir:

- Artırılmış gerçeklik uygulamalarının kullanım alanları genişletilerek daha kullanışlı hale getirilebilir,
- Artırılmış gerçeklik uygulamaları hakkında Türkiye'nin her ilinde panel, sempozyum gibi çalışmalarla öğretmen ve öğrenciler bilinçlendirilebilir,
- Artırılmış gerçeklik uygulamalarının eğitim sistemimizde yaygın kullanımı hızlandırılmalı,
- Artırılmış gerçeklik uygulamalarının kullanımı için gerekli ekipmanların ilgili kurum ve kuruluşlarca temini sağlanmalıdır.

Kaynakça

Coşkun, C. (2017). Bir Sergileme Yöntemi Olarak Artırılmış Gerçeklik, *Sanat ve Tasarım Dergisi*, (20), s. 61-75

Çakır, R , Solak, E , Tan, S . (2015). Artırılmış Gerçeklik Teknolojisi İle İngilizce Kelime Öğretiminin Öğrenci Performansına Etkisi, *Gazi Eğitim Bilimleri Dergisi*, 1 (2), s. 45-58.

Erbaş, Ç. & Demirer, V. (2014). Eğitimde Artırılmış Gerçeklik Uygulamaları: Google Glass Örneği, *Journal of Instructional Technologies & Teacher Education,* 3(2), 8-16

Gonzato, J. C., Arcila, T., & Crespin, B. (2008). Virtual objects on real oceans. In Graphıcon'2008 (pp. 49-54)

İbili, E. & Şahin, S. (2015). Artırılmış Gerçeklik ile İnteraktif 3D Geometri Kitabı Yazılımın Tasarımı ve Geliştirilmesi: ARGE3D. *Afyon Kocatepe Üniversitesi Fen Ve Mühendislik Bilimleri Dergisi*, 13 (1), s. 1-8

Koçoğlu, E. (2017). Yeni Bir Öğrenme Ortamı Olarak Artırılmış Gerçeklik Uygulamalarıyla Sosyal Bilgiler Öğretimi (ed. Sever, Aydın & Koçoğlu), Alternatif Yaklaşımlarla Sosyal Bilgiler Eğitimi, Ankara, s. 330-345

Korucu, A.T., Usta, E. & Yavuzaslan İ.F. (2016). Eğitimde Artırılmış Gerçeklik Teknolojilerinin Kullanımı: 2007-2016 Döneminde Türkiye'de Yapılan Araştırmaların İçerik Analizi, *Alan Eğitimi Araştırmaları Dergisi (ALEG),* 2(2), s. 81-92

Miles, M. ve Huberman, A. (1994). Qualitative Data Analysis: *An Expanded Source Book*, Thousand Oakes: Sage Publications

Milgram, P., & Kishino, F. (1994). A taxonomy of mixed reality visual displays. IEICE Transactıons on Information and Systems, 77(12), 1321-1329.

Özdemir, M . (2014). Nitel Veri Analizi: Sosyal Bilimlerde Yöntembilim Sorunsalı Üzerine Bir Çalışma, *Eskişehir Osmangazi Üniversitesi Sosyal Bilimler Dergisi*, 11 (1), s. 323-343

Somyürek, S . (2014). Öğretim Sürecinde Z Kuşağının Dikkatini Çekme: Artırılmış Gerçeklik, *Eğitim Teknolojisi Kuram ve Uygulama*, 4(1), s. 63-80

Türnüklü, A. (2000). Eğitimbilim Araştırmalarında Etkin Olarak Kullanılabilecek Nitel Bir Araştırma Tekniği: Görüşme, *Kuram ve Uygulamada Eğitim Yönetimi Dergisi*, *6*(4), s. 543-559

Yıldırım, A. ve Şimşek, H. (2008). Sosyal Bilimlerde Nitel Araştırma Yöntemleri. Ankara: Seçkin Yayıncılık.

The Impact of Technology Tools and Qualifications in Evaluating Individual

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Abstract: It can be said that since the birth of the human being is continuous from day to day, technological innovations are continuing, it can be said that the individual has an important influence on the level of perception and personal awareness. The use of technological equipments in education is seen in studies conducted where the individual shapes this level of awareness in many ways. In this study, which uses qualitative research methodology, technological equipment which emerged as the result of the changing individual and social needs analysis of the world and their characteristics, social, cultural, psychological, economic etc. the effects on the development of the areas should be determined in the direction of the opinions of the teacher candidates. Findings that emerged in the study revealed that prospective teachers had different perceptions about the topic.

Keywords: Technology, Learning, Technological competence, Digital literacy

Bireyin Değerlendirilmesinde Teknolojik Araçların ve Yeterliliklerin Etkisi

Özet: İnsanoğlunun doğuşundan günümüze kadar günden güne teknolojik yenilikler süreklilik gösterdiğinden dolayı bireyin algılama ve kişisel farkındalık düzeyi üzerinde önemli derecede etkili olduğu söylenebilir. Teknolojik ekipmanların eğitimde kullanımı, bireyin bu farkındalık düzeyini bir çok yönüyle şekillendirdiği yapılan çalışmalarda görülmektedir. Nitel araştırma yönteminin kullanıldığı bu çalışmada, dünyanın değişen bireysel ve toplumsal ihtiyaç analizinin sonucu olarak ortaya çıkan teknolojik ekipman ve bunların niteliklerinin bireyin sosyal, kültürel, psikolojik, ekonomik vb. alanlardaki gelişimi üzerindeki etkisini öğretmen adayları görüşleri doğrultusunda belirlemektir. Yapılan çalışmada ortaya çıkan bulgular, öğretmen adaylarının konuya ilişkin birbirinden farklı algılara sahip oldukları ortaya çıkmıştır.

Anahtar Kelimeler: Teknoloji, Öğrenme, Teknolojik yeterlik, Dijital okuryazarlık

Giriş

Eğitim sürecinde bireylerin eğitim seviyesi açısından değerlendirilmesi bakımında, eğitim teknolojilerinin ve öğrencilerin sahip olduğu teknolojik yeterlilik düzeylerinin etkisi yadsınamaz. Şöyle ki, teknolojik olanaklarla donatılmış bir öğrenme çevresinde teknolojik ortamının gerektirdiği niteliklerle öğrencilerin yetişebilmesi, onların zamansal ihtiyaç analizini daha güvenli bir biçimde belirlemeleri açısından oldukça önemlidir. Bundan dolayı 21. yüzyılın ihtiyaç piramidine göre şekillenen eğitimdeki öğrenme-öğretme sürecinde teknoloji temelli eğitimin etkisini dersin uygulayıcıları olan öğretmenler tarafından göz önünde bulundurulması gerekir. Bu gereklilik beraberinde öğretmenlerinde bu alanda kendilerini geliştirme zorunluluğunu beraberinde getirmektedir.

İnsanoğlunun hayatı günümüzün çağdaş dünyasındaki bilim ve teknoloji alanlarındaki hızlı gelişmeler doğrultusunda her yönüyle derinden etkilenmektedir. Günümüz insanının yeryüzündeki bu gelişmelere ayak uydurabilmesinin yanında bilim ve teknolojiye katkıda bulunabilmesi için her zamankinden daha çok eğitime yönelmesi gerekir. Çünkü bireyin bugünün şartlarına uygun, gelecekte de ortaya çıkacak yeni durumlara uyum gösterebilecek şekilde yetiştirilebilmesi, onları kendilerine uygun bir eğitimden geçirmekle mümkün olur (Batdal, 2005; Alpar, Batdal ve Avcı, 2007).

Günümüzde eğitim dünyasında yetişmekte olan nesillerin bu değişim sürecine adapte olabilmeleri konusunda en büyük sorumluluk, eğitim kurumlarına ve öğretmenlere düşmektedir (Yalçın Tepe ve Adıgüzel, 2017. Eğitim kurumlarının, öğretmenlerin, eğitimcilerin ve eğitim alan bireylerin bu değişim sürecine uyum sağlamaları önemli olup buna bağlı olarak eğitim kurumları fiziki ve teknolojik alt yapılarını aynı zamanda uyguladıkları eğitim programlarını da buna göre düzenlemeleri gerekmektedir. Kısacası "davranışçı" yaklaşımdan "yapılandırmacı" yaklaşıma doğru ilerleyen bir paradigma değişikliği yakalanmaya çalışılmaktadır (Çelikten, 2000; Kertil, 2008; Yalçın Tepe ve Adıgüzel, 2017). Eğitim alanındaki en önemli gelişmelerin başında iş ve eğitim dünyasının birbirinden ayrılmaz bir bütün olduğu görüşünün ortaya çıkmasıyla ortak ilgi alanları; etkin bir şekilde değişimi doğru yönetmek, direnç ve baskıları tanımlayabilmek, değişimin rotasını belirlemek, planlama yapmak ve değişim süreçlerinin herkes için ortak bir fayda sağlayacak şekilde uygulamaya koymak olduğu vurgulanmaktadır (Morrison, 1998; Yalçın Tepe ve Adıgüzel, 2017).

Eğitim dünyasında yukarıda ifade edilen değişiminde etkili olan en önemli faktörlerinde başında gelene teknoloji ve teknolojinden yararlanma yeteneği etkisi oldukça fazladır. Teknolojik araçların eğitim sürecindeki etkisini belirlemek amacıyla bu çalışma yapılmıştır.

Araştırmanın Amacı

Bu araştırmanın amacı, eğitimde öğrenme öğretme sürecinde kullanılan teknolojik araçların ve bireyin bu araçları kullanma yeterlilik düzeylerinin bireyin değerlendirilmesinde etkisini belirlemektir. Bu genel amaç çerçevesinde aşağıdaki sorulara cevap aranmıştır.

- ✓ Bir öğretmen adayı olarak teknolojik araçların eğitimindeki önemini hangi kavramlarla ifade edersiniz?
- ✓ Teknolojiden yararlanma yeterliliğine sahip olan bireyin öğrenme ortamında sahip olduğu avantajlar nelerdir?
- ✓ Öğrenme ortamında kullanılan teknolojik araçlar sizce hangi niteliklere sahip olmalıdır?

Yöntem

Araştırmanın Modeli

Eğitimde öğrenme öğretme sürecinde kullanılan teknolojik araçların ve bireyin bu araçları kullanma yeterlilik düzeylerinin bireyin değerlendirilmesinde etkisini öğretmen adaylarının görüşleri doğrultusunda belirlemeyi temele alan nitel araştırma yönteminin temele alınarak hazırlanan bu çalışmada Betimsel Tarama modeli kullanılmıştır

Çalışma Grubu

Eğitimde öğrenme öğretme sürecinde kullanılan teknolojik araçların ve bireyin bu araçları kullanma yeterlilik düzeylerinin bireyin değerlendirilmesindeki etkisini belirlemeyi amaç edinen bu araştırmada çalışma grubu üyelerini çeşitli üniversitelere bağlı eğitim fakültesi mezunlarından oluşan 30 öğretmen adayı oluşturmaktadır.

Veri Toplama Aracı

Araştırmada verileri elde etmek amacıyla araştırmacı tarafından uzman görüşü alınarak hazırlanan yarı yapılandırılmış görüşme formu kullanılmıştır. Formda yer alan soru maddeleri hazırlanırken öğretmen adaylarının konuya ilişkin yeterlilik düzeyleri dikkate alınarak hazırlanmış olup uzman denetiminden geçirildikten sonra yarı yapılandırılmış görüşme formuna son şekli verilmiştir.

Verilerin Analizi

Öğretmen adaylarının görüşlerinden hareketle öğretmen adaylarının yarı yapılandırılmış görüşme formuna vermiş oldukları cevapların analiz edilmesinde içerik ve betimsel analiz teknikleri kullanılmıştır. Öğretmen adaylarının görüşleri ortak temalar altında bir araya getirilerek tablolaştırılmıştır.

Bulgular

Teknolojik Araçların Eğitim Sürecinde Karşılayan Kavramlar Bulgusu

Araştırmada çalışma grubu üyelerine yarı yapılandırılmış görüşme formu aracılığıyla sorulan "*Bir öğretmen adayı olarak teknolojik araçların eğitimindeki önemini hangi kavramlarla ifade edersiniz?"* şeklinde soru yöneltilmiş olup çalışma grubu üyelerinin vermiş oldukları yanıtlar aşağıda tablo 1 de verilmiştir.

Tablo 1: Çalışma grubu üyelerinin teknolojik araçlara ilişkin önemi kavramlarla açıklamaya ilişkin görüşleri

1.Tema: Teknolojik Araçların Önemini Karşılayan Kavramlar	**f**
G.1. *Anlamlandırma-Somutlaştırma*	*5*
G.2. *Destekleyici Eğitim-Örneklendirme*	*7*
G.3.*Somutlaştırma-Örneklnedirme-Açıklama*	*7*
G.4.*Dikkat Çekme-Güdüleme-Anlamlandırma*	*11*

Çalışma grubu üyelerinin Tablo 1'de verilen bulguları incelendiğinde soru maddesine ilişkin olarak 4 farklı tema altında farklılaştıklarını görmekteyiz. Tablo 1 incelendiğinde öğretmen adaylarının teknolojik araçların öğrenme-öğretme sürecindeki önemini daha çok işlevsel olarak açıkladıkları söylenebilir.

Teknolojik Araçlardan Yararlanma Yeterliliğine İlişkin Bulgular

Araştırmada çalışma grubu üyelerine sorulan *"Teknolojiden yararlanma yeterliliğine sahip olan bireyin öğrenme ortamında sahip olduğu avantajlar nelerdir?"* şeklindeki soruya üyelerin vermiş oldukları yanıtlar tablo 2'de verilmiştir.

Tablo 2. Çalışma grubu üyelerinin teknolojik araçlardan kullanma yeterliliklerine ilişkin görüşleri

2.Tema: Teknolojik Araçları Kullanma Yeterlilikleri	**f**
G.1. *Başarı*	*5*
G.2. *Hızlı ve Etkin Öğrenme*	*5*
G.3.*Derse Katılım Düzeyi Yüksekliği*	*7*
G.4.*Bilinçli ve Anlamlı Öğrenme*	*13*

Çalışma grubu üyelerinin tablo 2 de vermiş oldukları yanıtlar incelendiğinde teknolojik araçlardan yararlanma yeterliliğine sahip olan öğrencilerin öğrenme ortamında öğretim hizmetinin niteliğini oluşturan öğelerden olumlu yönde yararlandıklarını öğretmen adaylarının görüşlerinden hareketle söyleyebiliriz.

Öğrenme Ortamında Kullanılan Teknolojik Araçların Sahip Olduğu Niteliklere İlişkin Bulgular

"Öğrenme ortamında kullanılan teknolojik araçlar sizce hangi niteliklere sahip olmalıdır?" Şeklinde çalışma grubu üyelerine yarı yapılandırılmış görüşme formunda yer alan soruya vermiş oldukları cevaplar tablo 3'de verilmiştir.

Tablo 3: Çalışma grubu üyelerinin teknolojik araçların niteliğine ilişkin görüşleri

3.Tema: Teknolojik Araçların Nitelikleri	**f**
G.1. *Açık-Sade ve Net olma*	*10*
G.2. *Öğrenci Seviyesine Uygunluk*	*5*
G.3.*İşlevsellik*	*5*
G.4.*Dikkat Çekme ve Öğrenciyi Güdüleme*	*10*

Çalışma grubu üyelerine yarı yapılandırılmış görüşme formu aracılığıyla sorulan *"Öğrenme ortamında kullanılan teknolojik araçlar sizce hangi niteliklere sahip olmalıdır?"* şeklindeki soruya vermiş oldukları yanıtlar incelendiğinde öğretmen adaylarının konuya ilişkin farklı algılara sahip oldukları tablo bakıldığında gözlemlenmektedir. Bu farklı algıların oluşmasında öğretmen adaylarının pedagojik yeterlilik düzeylerinin farklı olmasından kaynaklandığı söylenebilir.

Sonuçlar

Eğitimde öğrenme öğretme sürecinde kullanılan teknolojik araçların ve bireyin bu araçları kullanma yeterlilik düzeylerinin bireyin değerlendirilmesinde etkisini öğretmen adaylarının görüşleri doğrultusunda belirlemeyi temele alan bu araştırmada, elde edilen veriler incelendiğinde çalışma grubunu oluşturan öğretmen adaylarının vermiş oldukları yanıtların içerik analizine tabi tutularak elde edilen bulgular oldukça dikkat çekicidir.

Araştırmada teknolojik araçların sahip olduğu özellikler ve araçlardan üyelerin yararlanma yeterlilikleri ve teknolojik araçların önemini içeren kavramsal karşılıklar bakımından oldukça dikkat çekici sonuçlar ortaya çıkarmıştır. Bu sonuçlardan bazıları;

- ✓ Teknolojik farkındalık düzeyinin öğretmen adaylarında çeşitli algılar ortaya çıkardığını,
- ✓ Teknolojik araçların sahip olması gereken özelliklerin ihtiyaca göre farklılık gösterdiğini,

- ✓ Öğretim hizmetinin niteliğini oluşturan unsurlara sahip olma yeterliliğinin teknolojik araçları kullanma yeterliliğiyle eşdeğer olduğu şeklinde sonuçlara ulaşılmıştır.

Kaynakça

Alpar, D., Batdal, G. ve Avcı Y.(2007). Öğrenci Merkezli Eğitimde Eğitim Teknolojileri Uygulamaları, *Hasan Ali Yücel Eğitim Fakültesi Dergisi,* 7 (2007-1), 19-31.

Batdal, G. (2005). "Öğrenci Odaklı Bir Yaklaşımla İlköğretim Matematik Programlarının Değerlendirilmesi". *XIV. Ulusal Eğitim Bilimleri Kongresi,* Denizli: Pamukkale Üniversitesi, s.343-346.

Yalçın Tepe, F.D. ve Adıgüzel, T.(2017). Eğitim Kurumlarında Teknolojiyle Değişim Süreci: Bir Yüksek Öğretim Kurumu Örneği, *Elektronik Sosyal Bilimler Dergisi,* 16(63),1242-1261.

Çelikten, M. (2000). Okul Yöneticilerinin Değişim Yönetimi Becerileri. *Eğitim ve Bilim Dergisi,* 19(26).

Kertil, M. (2008). Matematik Öğretmen Adaylarının Problem Çözme Becerilerinin Modelleme Sürecinde İncelenmesi, Yayımlanmamış Yüksek Lisans Tezi. İstanbul.

Morrison, K. (1998). Management Theories forEducational Change. London: Paul Chapman Publishing Ltd. London.

Analysis of Domain Expert Opinion are in Line With the Harezmi Education Model Pilot Process in Turkey

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Abstract: Increasing the contribution of computer science to basic education and secondary education in Turkey, the determination of the principles of how to teach in an environment of various age groups and different backgrounds, mathematics interdisciplinary perspective of computer science, science, our country on behalf of the industry and how to draw the integration could frame with other areas such as social sciences 4.0 and to contribute to the education system through the application of sample lessons and plans to develop the computer science course and the curriculum in the framework of the 65th Government's 2016 Year Action Plan No. 130 (Actions and Reforms) title; The target of the implementation of the mosque education model in all schools of our country has been determined. The main aim of this study, supported by Inonu University Scientific Research Projects Coordination Unit under the normal research project, is to determine the opinions of the field experts on the effectiveness of the model and to evaluate them with the Envivo package program and to propose the modeling proposals. Working group members will be selected from the academics who have the necessary competencies in the model of the mausoleum. A number of questions prepared by the researcher are taken by the expert's opinion in order to get their views on the model through the semi-structured interview form from the members of the study group. The answers given to the questions will be evaluated with Envivo 11 package program and subjected to content analysis.

Keywords: Turkey, Harezmi, Curriculum, Technology

Türkiye'de Pilot Uygulama Sürecinde Olan Harezmi Eğitim Modelinin Alan Uzmanlarının Görüşleri Doğrultusunda Analizi

Özet: Bilgisayar bilimlerinin Türkiye'de temel eğitim ve orta öğretim öğrencilerine katkılarının artırılması, çeşitli yaş grupları ve farklı altyapıdaki ortamlarda nasıl öğretileceğinin ilkelerinin belirlenmesi, disiplinler arası bakış açısıyla bilgisayar bilimlerinin matematik, fen, sosyal bilimler gibi diğer alanlarla nasıl bütünleştirilebileceğinin çerçevesinin çizilmesi ile Ülkemiz adına endüstri 4.0 alanında eğitim stratejisinin belirlenmesi için yardımcı olmak ve aynı zamanda 65. Hükümetin 2016 Yılı Eylem Planı 130 sayılı (İcraatlar ve Reformlar) başlığı çerçevesinde Bilgisayar bilimleri dersi ve Müfredatı geliştirmede örnek ders uygulamaları ve planlamalarıyla eğitim sistemimize katkıda bulunmak amacıyla; Harezmi Eğitim modelinin ülkemizin tüm okullarında uygulanması hedefi belirlenmiştir. İnönü Üniversitesi Bilimsel Araştırma Projeleri Koordinasyon Birimi tarafından da normal araştırma projesi kapsamında desteklenen bu çalışmada temel amaç, modelin etkililiğine ilişkin alan uzmanlarının görüşleri belirlenip Envivo paket programıyla değerlendirilip modele ilişkin öneriler sunmaktır. Yapılan çalışmada çalışma grubu üyeleri Harezmi eğitim modeline ilişkin gerekli yeterliliklere sahip olan akademisyenlerden seçilecektir. Çalışma grubu üyelerinden yarı yapılandırılmış görüşme formu aracılığıyla modele ilişkin görüşlerini almak amacıyla uzman görüşü alınarak araştırmacı tarafından hazırlanan birkaç soru yöneltilip sorulara verilen cevaplar Envivo 11 paket programıyla değerlendirilip içerik analizine tabi tutulacaktır.

Anahtar Kelimeler: Türkiye, Harezmi, Eğitim programı, Teknoloji

Giriş

Günümüzde bilgi ve iletişim teknolojilerinin toplumlar üzerinde büyük etkisi vardır. Birçok alanda etkisini gösteren bu teknolojilerin yaygınlaşmasıyla birlikte toplumun bu değişimlere ayak uydurmak için kendini güncellemesi gerekir. Bundan 10-15 yıl kadar önce "Son on yılda yaratılan bilgi insanlığın başlangıcından bugüne kadar yaratılan bilgiden daha fazladır." denilmekteydi. Günümüzde, bilişim teknolojileriyle ilgilenen uzmanlar ve araştırmacılar bilgi birikiminin her iki yılda ikiye katlandığını ifade etmektedirler. Bu süre her geçen yıl kısalmaktadır (Acun, 1998; D'Angelo, 1995; Alakuş, 2005; Seferoğlu, 2007). Eğitimin temel amaçlarından biri olan toplumun ihtiyaç duyduğu bireyler yetiştirme görevi bilişim teknolojilerinin bilinip öğrencilere aktarılmasını zorunlu kılar. Bilgi ve iletişim teknolojilerini kullanarak bilgi edinmek, çok hızlı ve kolay olmasının yanında karmaşık bir süreçtir. Çünkü bu süreçte bireylerin, bilgi ve iletişim teknolojileri okuryazarlığı becerilerine sahip olmaları bir gerekliliktir. (Kaya & Durmuş, 2008).

Bilgi Teknolojilerinin eğitime entegrasyonu oldukça kolaydır. Eğitimde kullanılan Bilgi Teknolojileri sayısı fazladır ve bunlar dikkatlice ve yerinde kullanılırsa eğitimin etkililiğini artıracaktır. Bilgisayarlara dayalı bir eğitim ortamında, bilgisayarların yerinde ve etkili olarak kullanıldığı durumlarda öğrenme-öğretme sürecinin daha zenginleşeceği bir gerçektir. Bilgisayar donanım ve yazılımları öğrenme-öğretme sürecine yeni boyutlar getirecektir (Akkoyunlu, 1995). Milli Eğitim Bakanlığının resmi internet sayfasında geçen 11.11.2017 tarihli haberde Harezmî Eğitim Modelinden söz edilmiştir. Bu modelin yaşayan, canlı, dönüşen ders planlarından oluşan bir süreç olduğu açıklanmış ve bu modelin beş ana başlıktan oluşan zemini paylaşılmıştır. Bunlardan birincisi, bilgi işlemsel düşünme becerisiyle bilgisayar bilimleri öğretimi, ikincisi, programlarla öğretim araçları bilimleri öğretimi, üçüncüsü, disiplinler arası yaklaşımla bilgisayar bilimleri öğretimi, dördüncüsü, robotik ve oyun yolu ile bilgisayar bilimleri öğretimi, beşincisi sistem eğitimine sosyal bilimleri de ekleyerek bilgisayar bilimleri öğretimidir (http://www.meb.gov.tr/harezmi-egitim-modeli-tanitildi/haber/14943/tr).

Modelin zeminini oluşturan bu başlıkların ortak noktasına bakıldığında bilgisayar tabanlı bir öğretimin temele alındığı görülmektedir. 2017'de 5 pilot okulda uygulanan bu model 2018 yılında 50 pilot okulda uygulanmıştır. Eğitimcilerin yazıp, hazırlayıp değiştirecekleri ders planları ve uygulamalar sürekli güncellenecek ve ilk taslak planları ve dersin uygulanmasından sonra planın işe yarayıp yaramadığı, hangi bölümlerinin değiştirileceği hakkında tartışılacaktı. Böylece ders planı bütün süreç geçip gittikten sonra ortaya çıkacaktı.

Araştırmanın Amacı

Bu araştırmanın amacı pilot uygulama sürecinde olan Harezmî eğitim modelinin alan uzmanlarının perspektifinde analizini yapmaktır. Bu genel amaç çerçevesinde katılımcılara şu sorular sorularak cevap aranmıştır:

- Harezmî eğitim modelinin uygulanmasıyla öğrencilere kazandırılması hedeflenen beceriler nelerdir?
- Harezmî eğitim modelini sınıfında uygulayan öğretmenin özellikleri neler olmalıdır?
- Harezmî eğitim modelinin uygulanması öğrenme ortamına hangi yönden katkı sağlar?

Yöntem

Araştırmanın Modeli

Pilot uygulama sürecinde olan Harezmî eğitim modelinin alan uzmanlarının perspektifinde analizinin yapıldığı bu çalışma nitel araştırma yaklaşımına dayalı içerik analizi yöntemiyle gerçekleştirilmiştir. Nitel araştırma; sosyal olguları bağlı oldukları ve içinde yer aldıkları ortamda doğal görünümleriyle gözlem, görüşme ya da belgeleri değerlendirmek yoluyla bilgi edinme ve bu bilgileri analiz ederek kuram geliştirme olarak tanımlanabilir (İslamoğlu & Alnıaçık, 2013). Araştırmada nitel veri yöntemlerinden olan yarı yapılandırılmış görüşme formu kullanılmıştır. Patton (1987)'a göre araştırmacı, görüşme yöntemi kullanarak görüşme yapılan kişinin içsel dünyasına girmeye ve olayları onun perspektifinden anlamaya ve kavramaya çalışır (Türnüklü, 2000).

Çalışma Grubu

Bu çalışma Türkiye'nin farklı üniversitelerinde akademik hayatına devam eden Harezmî modelinde gerekli yetkinliğe sahip 50 akademisyenden seçilmiştir.

Veri Toplama Aracı

Araştırmanın kuramsal boyutu oluşturulduktan sonra değerlendirmesini yapabilmek için yarı yapılandırılmış görüşme formu hazırlanmıştır. Görüşme formu hazırlanırken öncelikle sorulacak sorular belirlenmiştir. Görüşme formu hazırlandıktan sonra iş hayatına devam eden bir akademisyenle ön görüşme yapılmış, görüşme tamamlandıktan sonra görüşme sorularına verdiği yanıtlar çözümlenerek dökümü yapılmıştır. Ön görüşmeye alınan kişi araştırma kapsamı dışında tutulmuştur. Araştırmada kullanılacak olan görüşme formu, İnönü Üniversitesinde görev yapan alan uzmanlarının, içerik geçerliliğini sağlamak amacıyla görüşlerine sunulmuştur. Alan uzmanlarından gelen görüş ve öneriler doğrultusunda görüşme formuna son şekli verilmiştir. Görüşme formunda 3 soru yer almaktadır.

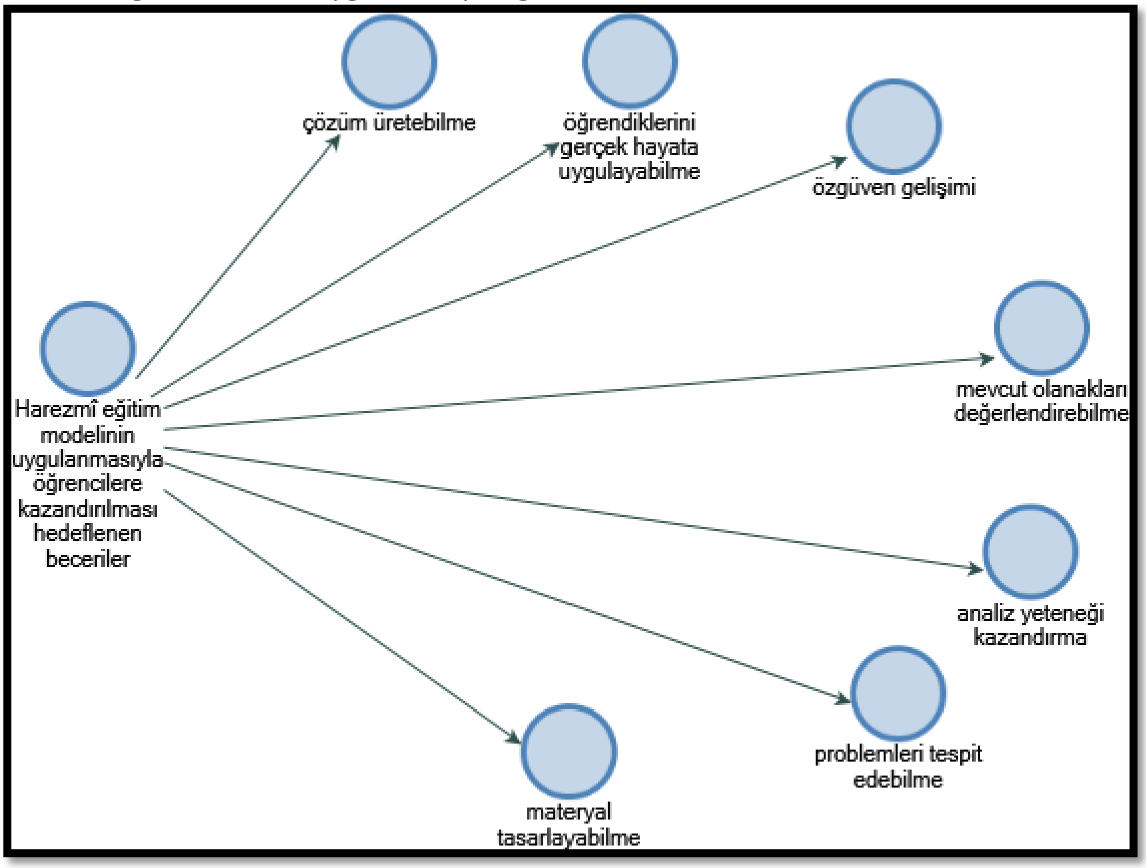
Verilerin Analizi

Araştırmada yarı yapılandırılmış görüşme formu ile ilgili çözümlemeler, nitel boyutta gerçekleştirilmiştir. Bilgisayar destekli nitel veri analizi yapılmıştır. Verilerin analizinde ve tabloların oluşturulmasında NVivo 11 programından yararlanılmıştır. Bu çerçevede, katılımcıların Harezmi eğitim modelinin değerlendirilmesine yönelik görüşleri içerik analizi tekniğiyle belli temalar altında bu görüşler gruplanarak çözümlenmeye çalışılmıştır. Araştırmanın güvenirliğini sağlamak için, araştırmada ulaşılan uzman görüşüne başvurulmuştur. Araştırmacılar ve uzmanlar tarafından öncelikle ana temalar ardından bunlara bağlı alt temalar oluşturulmuştur. Çözümlemeler sonucunda ortaya çıkan temalar aralarındaki bağları gösterir şekilde tablolaştırılmıştır. Tabloda yer alan ilişkileri gösteren temayı söyleyen kişi sayısı (frekansı) belirlenmiştir. Araştırmacıların ve uzmanın, temalarda yer alması gereken görüşlere ilişkin değerlendirmeleri karşılaştırılarak "görüş birliği" ve "görüş ayrılığı" sayıları tespit edilmiştir. Araştırmacı dışında iki uzmanla birlikte analizler yapılıp, Miles ve Huberman'ın (1994) formülüne göre araştırmacılar arasındaki uyum hesaplanmıştır. Bu hesaplama sonucunda, P =(83/83+1) x 100 = %92 olarak hesaplanmıştır.

Bulgular

Bu bölümde, akademisyenlerin Harezmî eğitim modeline ilişkin görüşleri genel başlıklar halinde temalara ve verilen ortak cevaplar doğrultusunda alt temalara dönüştürüldükten sonra frekans değerleri bulunmuş ve tablolar halinde sunulmuştur.

Harezmî eğitim modelinin uygulanmasıyla öğrencilere kazandırılması hedeflenen beceriler durumu

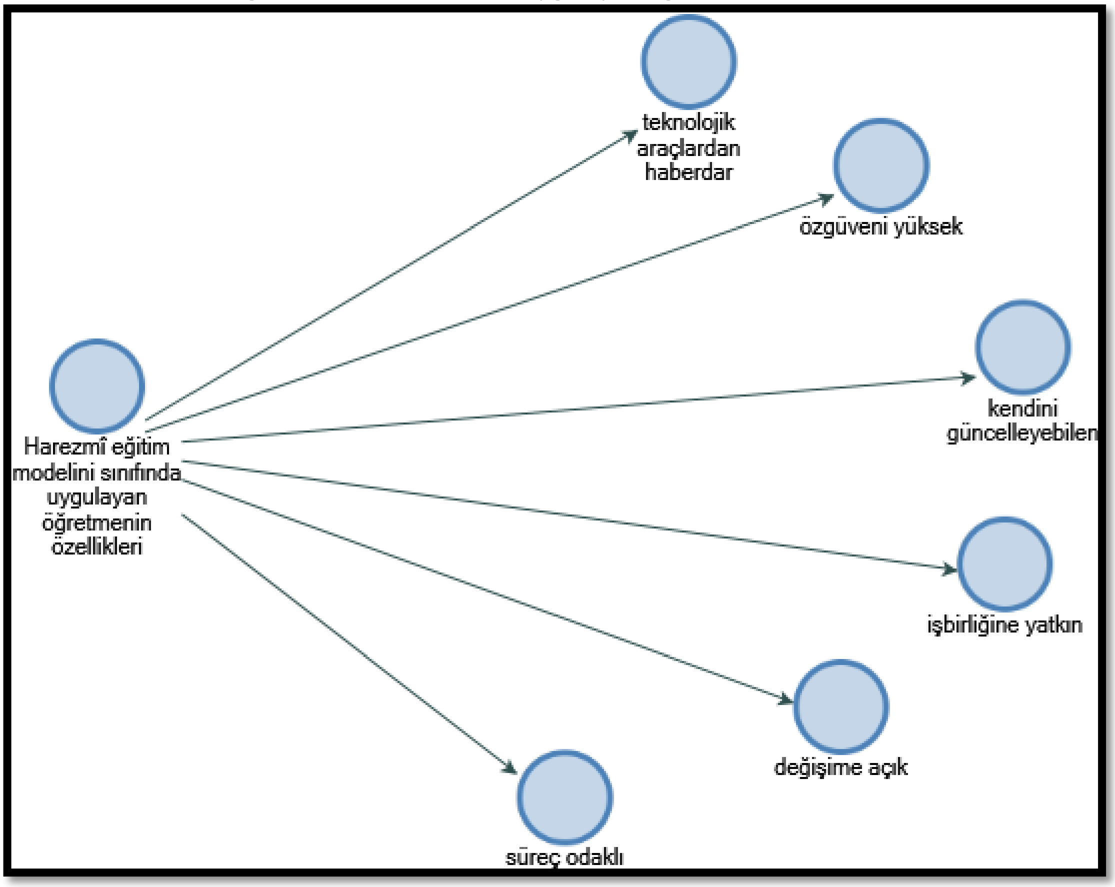


Şekil 1. Harezmî eğitim modelinin uygulanmasıyla öğrencilere kazandırılması hedeflenen beceriler durumu sonuçları

Çalışma grubunu oluşturan akademisyenlere yarı yapılandırılmış görüşme formunda yer alıp yöneltilen "Harezmî eğitim modelinin uygulanmasıyla öğrencilere kazandırılması hedeflenen beceriler nelerdir?" şeklindeki soruya akademisyenlerin birbirinden farklı yanıtlar vererek farklılaştıkları şekil 1'de görülmektedir. Soruya verdikleri cevaplar incelendiğinde; materyal tasarlayabilme (f=5), öğrendiklerini gerçek hayata uygulayabilme (f=6), analiz yeteneği kazandırma (f=6), çözüm üretebilme (f=7), özgüven gelişimi (f=8), öğrendiklerini gerçek hayata uygulayabilme (f=9), problemleri tespit edebilme (f=9), temalarının ortaya çıktığı görülmektedir. Harezmi eğitim modelinin uygulanmasıyla öğrencilere kazandırılması hedeflenen becerilerle ilgili akademisyen görüşlerinin birbirinden farklı olmasının bu eğitim modelinin çok yönlü fayda sağlayacak bir model olacağından kaynaklandığını söylemek mümkündür. Katılımcıların bu temaya ilişkin ifadeleri aşağıda örneklendirilmiştir:

"Harezmi eğitim modelinin uygulanmasıyla öğrenciler kendi deneyimleri ve düşünceleriyle, kendi becerilerini, yeteneklerini ortaya çıkarır. Bu modelde öğrenci, öğrenme sürecinde son derece aktiftir. Çevresinde ortaya çıkan problemleri araştırır ve elde ettiği bilgileri geçmiş yaşantılarıyla ilişkilendirip analiz eder. " (analiz yeteneği kazandırma-erkek)

Harezmî eğitim modelini sınıfında uygulayan öğretmenin özellikleri durumu

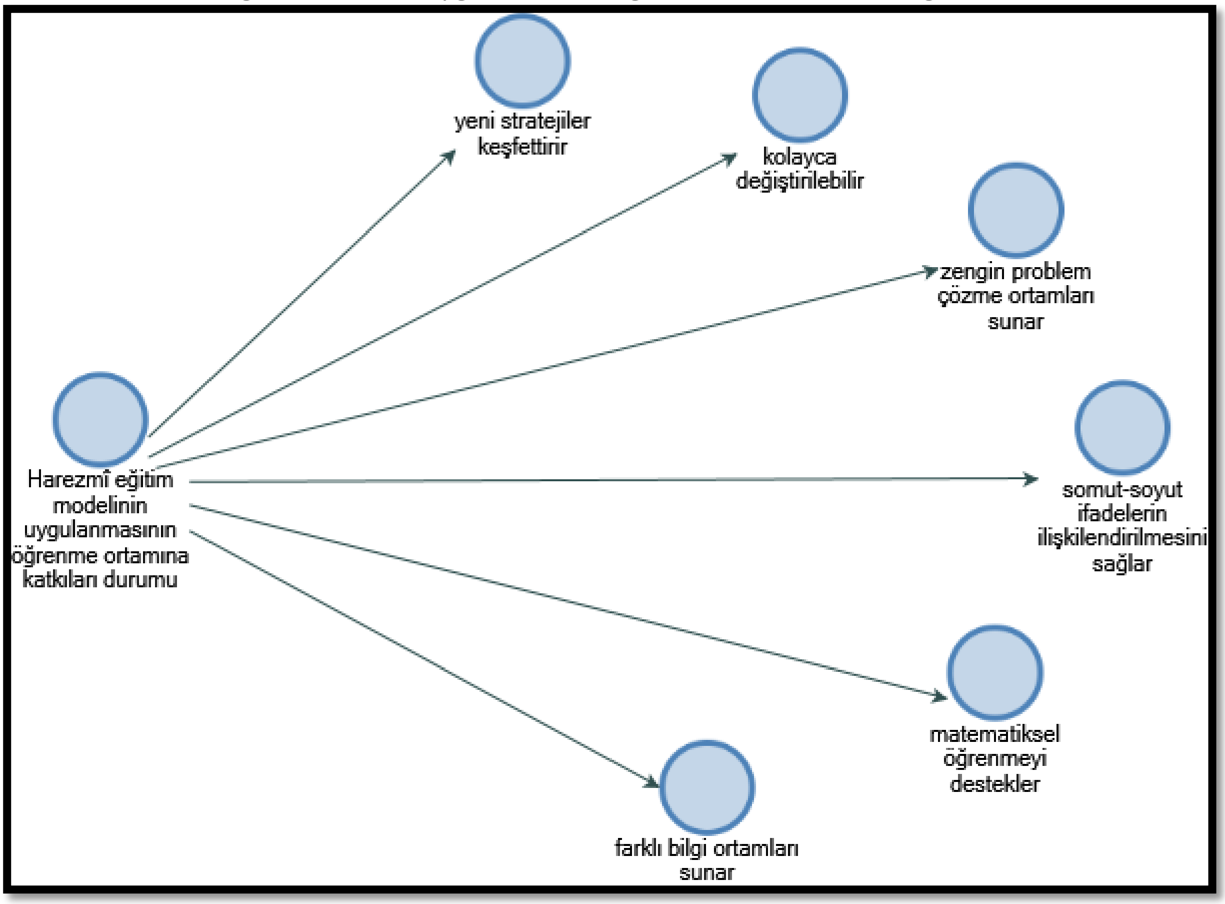


Şekil 2. Harezmî eğitim modelini sınıfında uygulayan öğretmenin özellikleri durumu

Çalışma grubunu oluşturan akademisyenlere yarı yapılandırılmış görüşme formunda yer alıp yöneltilen "Harezmî eğitim modelini sınıfında uygulayan öğretmenin özellikleri neler olmalıdır?" şeklindeki soruya akademisyenlerin birbirinden farklı yanıtlar vererek farklılaştıkları şekil 2'de görülmektedir. Soruya verdikleri cevaplar incelendiğinde; özgüveni yüksek (f=4), kendini güncelleyebilen (f=6), işbirliğine yatkın (f=8), süreç odaklı (f=9), teknolojik araçlardan haberdar (f=11), değişime açık (f=12), temalarının ortaya çıktığı görülmektedir. En yüksek frekansa sahip iki tema "teknolojik araçlardan haberdar" ve "değişime açık" temalarıdır. Akademisyenlerin Harezmî eğitim modelinin uygulayıcıları olan öğretmenlerde bu özelliklerin olması gerektiğini savunmalarının modelin temelinde bilgisayar bilimleri öğretiminin olmasından kaynaklandığını söylemek mümkündür. Katılımcıların bu temaya ilişkin ifadeleri aşağıda örneklendirilmiştir:

"Harezmi eğitim modelini öğrenme ortamında kullanacak olan öğretmen teknolojik araç gereçlerden her zaman haberdar olmalıdır. Zira modelin temel dayanağı bilgisayar ve ekipmanlarından oluşur. Çocuklar gelişen ve değişen teknolojiye hızla ayak uydurabilmektedir. Bu da dinamik bir öğretmen olmak için değişen teknolojinin sıkı takipçisi olmasını gerekli kılar." (teknolojik araçlardan haberdar-erkek).

Harezmî eğitim modelinin uygulanmasının öğrenme ortamına katkı sağlama durumu



Şekil 3. Harezmî eğitim modelinin uygulanmasının öğrenme ortamına katkı sağlama durumu sonuçları

Çalışma grubunu oluşturan akademisyenlere yarı yapılandırılmış görüşme formunda yer alıp yöneltilen "Harezmî eğitim modelinin uygulanması öğrenme ortamına hangi yönden katkı sağlar?" şeklindeki soruya akademisyenlerin birbirinden farklı yanıtlar vererek farklılaştıkları şekil 3'te görülmektedir. Soruya verdikleri cevaplar incelendiğinde; yeni stratejiler keşfettirir (f=5), farklı bilgi ortamları sunar (f=9), somut-soyut ifadelerin ilişkilendirilmesini sağlar (f=10), zengin problem çözme ortamları sunar (f=11), kolay değiştirilebilir (f=12), matematiksel öğrenmeyi destekler (f=13) temalarının ortaya çıktığı görülmektedir. Katılımcıların bu temaya ilişkin ifadeleri aşağıda örneklendirilmiştir:

"Geleneksel sınıflarda yeni teknolojilerin kullanılması için bu güne kadar pek çok girişimde bulunulmuştur. Harezmî eğitim modeli ile öğretmenler bir amacı gerçekleştirmek için ya da belli kazanımları öğrencilere kazandırmak için birbirinden faklı birçok ortam sunma imkânına sahip olacaklardır. Bu Harezmî eğitim modelinin öğrenme ortamına sağladığı katkılardan yalnızca biridir (farklı bilgi ortamları sunar-erkek).

Sonuç ve Öneriler

Öğretim teknolojilerindeki gelişmeler her geçen gün hızla artmaktadır. Hem teknoloji hem de bilgi boyutunda yaşanan bu değişimler sonucu, eğitim kurumlarının da öğrenmenin niteliğini artırmak, teknoloji okur-yazarı bireyler yetiştirmek, daha geniş bir kitleye eğitim hizmeti götürebilmek ve eğitim maliyetlerini azaltmak gibi nedenlere dayalı olarak öğretim teknolojilerini kullanmaları beklenmektedir (Gülbahar, 2005).

Türkiye'de pilot uygulama sürecinde olan Harezmî eğitim modelinin alan uzmanlarının perspektifinde analizi adlı bu çalışmada katılımcıların görüşleri doğrultusunda bu modelin eğitim ortamlarına entegre edilmesinin birçok fayda sağlayacağını söylemek mümkündür. Zengin öğrenme ortamları sunan, matematiksel öğrenmeyi destekleyen kolayca dersin içeriğini ve müfredatını değiştirilebilen bu modelle öğrenciler analiz yeteneğine, özgüven gelişimine, problem tespiti gibi yeteneklere sahip olabileceklerdir.
Çalışmadan hareketle şu öneriler geliştirilebilir:

- Bu model sadece pilot okullarla sınırlı kalmayıp Türkiye'nin bütün illerinde yaygın olarak kullanılabilir,

- Bu modelle ilgili daha fazla alan yazın çalışmaları yapılabilir, eğitim ortamlarının yöneticileri olan öğretmenler bu konuda aydınlatılabilir,
- Eğitim fakültesi öğrencileri için bu modelin ne olduğunu, yeterlilikleri ve sınırlılıklarının neler olduğunu anlatan konferans ve sempozyumlar düzenlenebilir,

Kaynakça

Akkoyunlu, B. (1995). Bilgi teknolojilerinin okullarda kullanımı ve öğretmenlerin rolü. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *11*(11).

Gülbahar, Y. (2005). Web-Destekli Ögretim Ortaminda Bireysel Tercihler. *TOJET: The Turkish Online Journal of Educational Technology*, *4*(2)

İslamoğlu, A.H. & Alnıaçık, Ü. (2013). Sosyal Bilimlerde Araştırma Yöntemleri (Gözden geçirilmiş ve genişletilmiş 3. Baskı), İstanbul, Beta Basım Yayım Dağıtım.

Kaya, S., & Durmuş, A. (2008). Öğretmen adaylarının bilgi okuryazarlığı ve araştırma yaparken interneti kullanma düzeyleri. *Uluslararası Bilgisayar ve Öğretim Teknolojileri Sempozyumu Sempozyum Kitabı (ss. 778-786). Kuşadası: Türkiye*.

Seferoğlu, S. S. (2007). İlköğretim bilgisayar dersi öğretim programı: Eleştirel bir bakış ve uygulamada yaşanan sorunlar. *Eurasian Journal of Educational Research (EJER)*, (29) s. 99-111

Türnüklü, A. (2000). Eğitimbilim Araştırmalarında Etkin Olarak Kullanılabilecek Nitel Bir Araştırma Tekniği: Görüşme, *Kuram ve Uygulamada Eğitim Yönetimi Dergisi*, *6*(4), s. 543-559

Evaluation of the Empathic Tendencies of Pre Licence Students in Terms of Various Variables

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Abstract: It is expected that the interpersonal relations of the teachers and preschool educators who serve as master trainers in pre-school education are good and have empathy ability. For this reason, this study was conducted in order to determine the empathic tendencies of the child development specialists who are a member of institutions serving in early childhood in the course of their education. The sample of the research was consisted by 77 students attending in the Child Development Program of Kafkas University Social Sciences Vocational School in the academic year of 2017-2018. Personal information form and "Empathic Tendency Scale" developed by Dökmen (1988) were used in this research. It was determined that 77.9% of the students who participated in the survey were in the age range of 18-20 years and the family income level of 48.1% was between 1001tl-2000tl. According to the data, the empathic tendency point average of the students participating in the study 64,94. When the graduated high school types were taken into consideration, it was determined that the empathic tendency levels of the students differ significantly in favor of the students graduated from the Girl Vocational High School (U=518,5; p<0,05). However, the empathic tendency levels of the students who are studying second class (U=473,0; p<0,05) with the students who fondly preferred the department were found to be significantly higher (U=214,0; p<0.05). According to the results of the research, students should be encouraged to prefer the professions they are able to do while directing to the profession.

Keywords: Empathic tendency, Child development program, Pre-school education

Introduction

Empathy is defined as a person's act of putting himself/herself to another's place in order to gain their perspective on events, understanding the feelings and thoughts of that person properly, feeling them and transmitting this process to that person (Gökler, 2009; Özkan, 2014).

Empathy is a skill which makes it easier for individuals to get closer and understand each other in daily life. Moreover, it helps people understand each other correctly (Balat et al., 2014). Besides of daily life, empathy is also a very important issue in the professional sense. Other than the child's family, teachers in preschool education and child development experts who work as qualified instructors are role models of children and also responsible for their development and education. Teachers who can empathize can put themselves in children's places in order to see from their perspective, easily manage crises in the classroom, and communicate with students and parents in a healthy way (Balat et al., 2014). That is why people working in this field are expected to have good personal relations and be able to empathize (Çelik & Çağdaş, 2010).

Based on this expectation, this study was conducted in order to determine empathetic tendencies of child development experts during their education, who are a member of institutions that serve children in their early childhood.

Method

The sample of the study consists of 77 students who are receiving their education in Kafkas University Vocational School of Social Sciences Child Development Program in the 2017-2018 academic year. "Personal Information Form" and "Empathetic Tendency Scale" were used in the research.

Personal Information Form is composed of questions about students' personal information including gender, age, graduated high school type, the class they were educated in, whether they gladly chose the program they are being educated in or not, family type, sibling number and monthly income status.

Empathetic Tendency Scale was developed by Dökmen (1988) in order to measure the potential of people to empathize in daily life. Answers vary from "completely against" to "completely for" in the scale that was prepared in the form of a Five Point Likert Scale. On the scale; items 3,6,7,8,11,12,13 and 14 are negative signs, and are graded in reverse. The total points obtained from normal and reverse items gives that person's empathetic tendency points.

Cronbach alpha reliability coefficient that was calculated for this research is 0.799. This value shows that the data is reliable.

Since the data does not conform to the normal distribution, Mann Whitney-u and Kruskal Wallis tests were preferred among nonparametric tests for analysis. The data collected toward the goal of the research were evaluated and their statistical analyses were made in SPSS 18 statistics program.

Results and Discussion

In this section, findings from the research about empathetic tendencies of students are presented.

Table 1. Empathetic tendency levels of students who participated in the research

	N	Highest Point	Lowest Point	$\overline{X}$	SS
Empathetic Tendency	77	94.0	20.0	64.94	12.01

When Table 1 is examined, it is seen that the empathetic tendency levels of the students participating in the research $\overline{X}$ = 64.94 and their standard deviation values SS = 12.01. Empathetic tendency points of students were determined to be around average values.

Table 2. Empathetic tendency levels of students according to gender

Gender	N	Mean Rank	Rank Sum	U	*P*
Female	66	39.75	2623.5	313.5	0.470
Male	11	34.50	379.50		

It was determined that there is no significant difference between empathetic tendency levels of students and the gender variable ($p>0.05$). According to the results of the research, although empathetic tendency points of female students are higher than the points of male students, the fact that the difference between them is not significant shows similarity with the study conducted on teachers by Bulut and Düşmez (2014).

Table 3. Empathetic tendency levels of students according to age

Age Levels	N	Mean Rank	X^2	*p*
ages 18-20	60	38.98		
ages 21-23	14	36.86	0.792	0.673
ages 24+	3	49.50		

It was determined that there is no significant difference between empathetic tendency levels of students and the age variable according to the results of Kruskal Wallis test in Table 3 (X^2 =0.792; $p>0.05$) .

Table 4. Empathetic tendency levels of students according to high school type

High School Type	N	Mean Rank	Rank Sum	U	*P*
Vocational High School	45	43.48	1956.5	518.5	0.037
Other High School Types	32	32.70	1046.5		

A positively significant difference was found in the empathetic tendency levels of the students studying in vocational high schools (U = 518.5; $p<0.05$). No comparison could be made, since there were no variables related to graduated high school types in previous studies that came up in the literature review.

Table 5. Empathetic tendency levels of students according to class levels

Class Level	N	Mean Rank	Rank Sum	U	*P*
1st Grade	42	32.76	1376.0	473.0	0.007
2nd Grade	35	46.49	1627.0		

A positively significant difference was found in the empathetic tendency levels of the students who are in 2nd grade (U = 473.0; $p<0.05$). When class levels were examined in the study conducted by Ekinci & Aybek (2010), no significance difference was detected between 1st grade and last grade. This case shows similarities with this study.

Table 6. Empathetic tendency levels of students according to the variable of willingly choosing the department

Choosing the Department Willingly	N	Mean Rank	Rank Sum	U	*P*
Yes	66	41.26	2723.0	214.0	0.030
No	11	25.45	280.00		

A positively significant difference was found in the empathetic tendency levels of students who came to the department willingly (U = 214.0; $p<0.05$). In the study by Bulut & Düşmez (2014), it was determined that willingly choosing the profession did not have a significant difference on the empathetic tendency points, and it was similar to findings in this study.

Table 7. Empathetic tendency levels of students according to family types

Family Types	N	Mean Rank	X^2	*p*
Elementary Family	48	40.36		
Extended Family	27	36.28	0.644	0.725
Fragmented Family	2	43.00		

It was determined that there is no significant difference between empathetic tendency levels of students and family type according to the results of Kruskal Wallis test in Table 7 ($X^2 = 0.644$; $p>0.05$) .

Table 8. Empathetic tendency levels of students according to number of siblings

Number of Siblings	N	Mean Rank	X^2	*p*
Only Child	2	20.75		
1 Sibling	4	26.00	3.335	0.343
2 Siblings	9	44.78		
3 or More Siblings	62	39.59		

According to the results of Kruskal Wallis test in Table 8, no significant difference was found between the empathetic tendency levels of the students and number of siblings ($X^2 = 3.335$; $p> 0.05$)

Table 9. Empathetic tendency levels of students according to family income levels

Family Income Level	N	Mean Rank	X^2	*p*
1000 TRY and below	17	43.12		
1001 - 2000 TRY	37	35.31	5.233	0.156
2001 - 3000 TRY	15	48.03		
3001 TRY and above	8	30.38		

It was determined that there is no significant difference between empathetic tendency levels of students and family income levels according to the results of Kruskal Wallis test in Table 9 ($X^2 = 5.233$; $p>0.05$) . While it was expressed that socioeconomic situation created a significant difference in the study conducted by Ekinci and Aybek in 2010, it is seen that this case does not coincide with this study.

According to the results of the study, situation of students about gladly choosing their department effects empathetic tendency levels positively. In addition, empathetic tendency levels of students who graduated from Girls' Vocational School show positive distribution compared to students who graduated from other types of high schools. No significant difference was found between other variables and empathetic tendency levels of students.

Recommendations

According to results of the research, while students are making their choices of profession, they should be supported to choose professions they would be happy with. In addition, different programs can be planned toward improving empathetic tendency levels who study in other types of high school than girls' vocational school. Studies in this field should be increased in order to contribute to the literature.

References

Balat Uyanik, G., Çelebi G., Yılmaz, H., Gümüştekin, T., (2014). Emotional Intelligence and Empathetic Tendency: A Research on Preschool Teachers, *Turkish Studies - International Periodical for the Languages, Literature and History of Turkish or Turkic*, Volume 9/8, p. 893-901.

Bulut, H., Düşmez, Ü., (2014). Comparison of Empathetic Tendency Skills of Teachers With Regard to Demographic and Vocational Variables, *Iğdır University Social Sciences Magazine*, Issue: 5, 105-115.

Çelik, E., Çağdaş, A., (2010). Examination of Empathetic Tendencies of Preschool Education Teachers With Regard to, *Selçuk University Social Sciences Institute Magazine*, Issue: 23, 23-37.

Dökmen, Ü. (1988). Measuring Empathy Based on a New Model and Improving it Through Psychodrama, *Ankara University Faculty of Educational Sciences Magazine* , 21 (1-2), 155-190.

Ekinci, Ö., Aybek, B., (2010). Examination of Empathetic and Critical Thinking Tendencies of Teacher Candidates, *Elementary Online*, 9(2), 816-827.

Gökler, R., (2009). Adaptation of Empathetic Tendency Scale for Eight Grade Elementary Classes, *Family and Society,* Year: 11, Volume: 5, Issue: 19, s: 77-86.

Özkan, B., (2014). Examination of Empathy Levels of Preschool and Form Teachers, *The Journal of Academic Social Science Studies*, 30, 509-514.

Using Optimization Software for Solving Linear Systems

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Abstract: This study examines the use of optimization application software to solve linear systems because there are some complex linear systems that have a set of solutions, but the optimal solution is the one that satisfies all the system. The study was based on a linear system as a case study, which was solved using SimSolve and Matrix Calculator as a software designed using the traditional methods to solve the linear system under investigation. The same system was also solved again using the optimization software; Excel Solver and Lindo 6.1, where there was no difference in the correct solution in both methods. Then, the linear system, which is used as a case study, was modified to become more complex. When the new system was resolved using the mentioned software, the results were in favor of the optimization software Solver and Lindo 6.1; they could provide solutions with a margin of error, while, SimSolve and Matrix Calculator software, designed with traditional algorithms, failed to achieve a result. Based on these results, the study recommends introducing optimization software within the mathematics curriculum in the advanced stages of the educational system and training for both teachers and students to use such software in order to reduce the time and effort exerted for solving systems, and to obtain the best results when solving these systems. It is recommended to make use of information and communication technologies that make learning mathematics more easily to increase reliability on mathematical models in solving life problems.

Keywords: Linear systems, Optimization software, Information technology, Life problems

Introduction

When constructing mathematical models of different problems, multiple mathematical systems are produced, including linear systems. And increasing the number of equations and unknowns in the linear system increases the difficulty in finding a solution. So that the solution using software is a must . In addition to the existence of some linear systems that do not have a single solution to achieve all the constraints. There is a zone of solutions, not a single point. Therefore, it is necessary to search for the best point to represent the solution (optimization). In this paper we use linear system contains 4 variables in 6 equations as a case study.

$6.2\ \mathbf{x}_1 - 0.3\ \mathbf{x}_2 + 1.9\ \mathbf{x}_4 = -22.375$
$2.5\ \mathbf{x}_1 + 3.4\ \mathbf{x}_4 = -8.75$
$0.8\ \mathbf{x}_1 + 2.1\ \mathbf{x}_2 - 0.5\ \mathbf{x}_3 = 2.325$
$-0.4\ \mathbf{x}_2 - 7.4\ \mathbf{x}_3 + 0.1\ \mathbf{x}_4 = 5.02$
$1.5\ \mathbf{x}_1 - 8.2\ \mathbf{x}_2 + 3.1\ \mathbf{x}_3 = -26.18$
$6.2\ x_1 + 6.2\ \mathbf{x}_2 + 0.1\ \mathbf{x}_3 - 8.7\ \mathbf{x}_4 = 13.87$

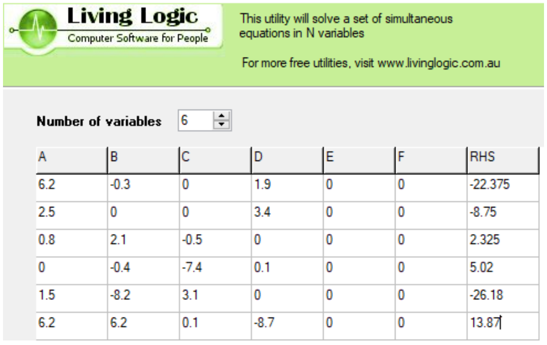
In this case study the number of unknowns is less than the equations, so the argument matrix will not be square matrix, we use four software to solve this system. Two of these software are based on matrix theory and use direct methods of solving linear system. This software is SimSolve and Matrix Calculator. The other two software Excel Solver and Lindo 6.1 are considered optimization software.

How to use the Software to Find a Solution

Now we are going to illustrate the steps of finding solution for each software.

SimSolve

General purpose and free simultaneous equation solver. Just specify the number of variables, enter the coefficients, and press solve. Reports the numerical solution if only one exists, describes the constraints if infinite solutions exist, and tells you its impossible if no solution exists. The "show workings" mode explains how the program came to its conclusions. In this case study we put the number of variables as the number of equations. And put A,B,C,D,… instate of the variables x_1, x_2, x_3, x_4, … as seen in figure .1



A	B	C	D	E	F	RHS
6.2	-0.3	0	1.9	0	0	-22.375
2.5	0	0	3.4	0	0	-8.75
0.8	2.1	-0.5	0	0	0	2.325
0	-0.4	-7.4	0.1	0	0	5.02
1.5	-8.2	3.1	0	0	0	-26.18
6.2	6.2	0.1	-8.7	0	0	13.87

Figure 1. SimSolve input

Then by pressing solve we get : $x_1 = -3.5$, $x_2 = 2.25$, $x_3 = -0.8$, $x_4 = 0$

Matrix Calculator

It is an online application, Enter coefficients of your system into the input fields. Leave cells empty for variables, which do not participate in your equations. As shown figure 2

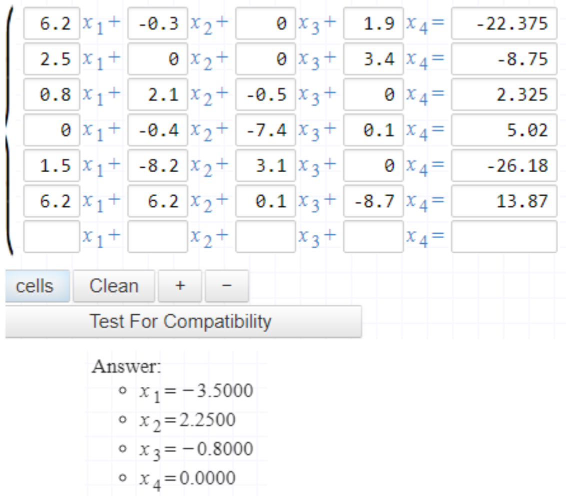


Figure 2. Matrix Calculator input, output

Excel solver

Excel solver is an add-ins tool in Microsoft Excel, it is an optimizer tool. To use solver for solve linear system, follow the steps

Change the variables names form x1, x2, x3, x3 , x4, into the cells name c1, c2, c3, c4, and these cells will contains the solution. Then the system will be as :

6.2 **c1** - 0.3 **c2** + 1.9 **c4** = -22.375
2.5 **c1**+ 3.4 **c4** = -8.75
0.8 **c1** + 2.1 **c2** - 0.5 **c3** = 2.325
-0.4 **c2** - 7.4 **c3** + 0.1 **c4** = 5.02
1.5 **c1** - 8.2 **c2** + 3.1 **c3** = -26.18
6.2 **c**1+ 6.2 **c2** + 0.1 **c3** - 8.7 **c4** = 13.87

Enter the equations in the cells A1 , A2 , A3 , A4 , A5 and A5 . And enter the constants in the cells B1, B2, B3, and B4 respectively.Click Solver button, the Solver Parameters dialog box will appear as in figure 3

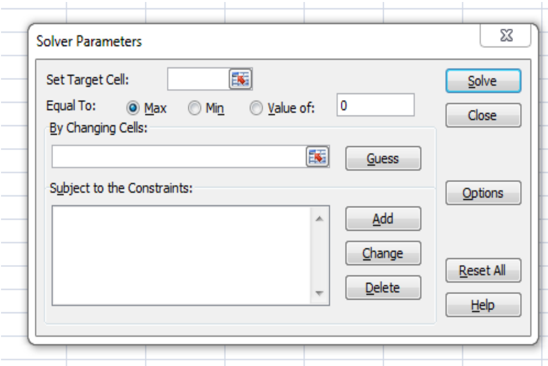


Figure 3. Solver Parameters

Clear Set Target Cell box
In By Changing Cells select the cells c1, c2, c3, c4
In Subject to the Constrains choose Add
Dialog box Add constrains will appear as shown in Figure 4.

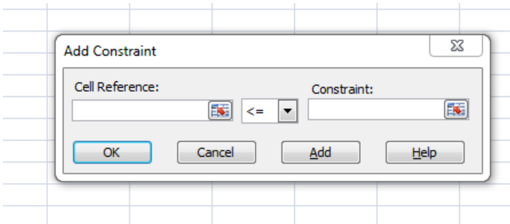


Figure 4. Add Constrains

In Cell Reference select the cells A1, A2, A3 and A4.
In Constrains select B1, B2, B3, and B4
Then Ok and Solve and Ok

Lindo 6.1

Design the linear system as a linear programming system which has a goal of Max or Min value, but here in linear system we just put Max or Min for one of our variables so as to fill the form, and the model is very simple to write as follows:

Max
X1
St
$6.2\ \mathbf{x}_1 - 0.3\ \mathbf{x}_2 + 1.9\ \mathbf{x}_4 = -22.375$
$2.5\ \mathbf{x}_1 + 3.4\ \mathbf{x}_4 = -8.75$
$0.8\ \mathbf{x}_1 + 2.1\ \mathbf{x}_2 - 0.5\ \mathbf{x}_3 = 2.325$
$-0.4\ \mathbf{x}_2 - 7.4\ \mathbf{x}_3 + 0.1\ \mathbf{x}_4 = 5.02$
$1.5\ \mathbf{x}_1 - 8.2\ \mathbf{x}_2 + 3.1\ \mathbf{x}_3 = -26.18$
$6.2\ x_1 + 6.2\ \mathbf{x}_2 + 0.1\ \mathbf{x}_3 - 8.7\ \mathbf{x}_4 = 13.87$
End
Free x1
Free x2
Free x3
Free x4
Using of Free command is for the negative values.
In this case study all the software gives same solution.

Table 1. Solutions of case study before modify

Variable	SimSolve solution	Matrix Calculator solution	Excel Solver solution	Lindo 6.1 solution
X1	-3.5	-3.5	-3.5	-3.5
X2	2.25	2.25	2.25	2.25
X3	-0.8	-0.8	-0.8	-0.8
X4	0	0	0	0

Method

Modifying the Case Study

Now we are going to modify the system to check the Software efficiency in choosing the right solution.
substitute the solution in $1.15\ x1 + 1.8\ x2$ this produce 0.025
Adding this equation ($1.15\ X1 + 1.8\ X2 = 0.025$) to the previous system does not generate a new system, but by changing the constant of this equation from 0.025 to 0.0, a new complicated system will be generated as:

$6.2\ x1 - 0.3\ x2 + 1.9\ x4 = -22.375$
$2.5\ x1 + 3.4\ x4 = -8.75$
$0.8\ x1 + 2.1\ x2 - 0.5\ x3 = 2.325$
$-0.4\ x2 - 7.4\ x3 + 0.1\ x4 = 5.02$
$1.5\ x1 - 8.2\ x2 + 3.1\ x3 = -26.18$
$6.2\ x1 + 6.2\ x2 + 0.1\ x3 - 8.7\ x4 = 13.87$
$1.15\ x1 + 1.8\ x2 = 0$

The new system (case study after modifying) was solved using same software. And the solutions shown in Table 2.

Table 2. Solutions of case study after modify

Variable	SimSolve solution	Matrix Calculator solution	Excel Solver solution	Lindo 6.1 solution
X1	No solution	No solution	-3.46472	-3.497354
X2			2.213569	2.234421
X3			-0.79838	-0.799308
X4			-0.02594	-0.011095

Results and Discussion

SimSolve and Matrix Calculator software that use traditional methods or direct methods failed to achieve solution for the system after modify. Optimization software Excel Solver and Lindo 6.1 give a solution for the system after modify. Differences in system solution after modification in favor of Lindo 6.1 as seen in Table 3. That shows verification of the solutions in each equation in the new system.

Table 3. Result comparing

	Error			
	Excel Solver	LINDO6.1	Matrix Calculator	SimSolve
Equation 1	-0.180389	0.000001	No Solution	No Solution
Equation 2	0	0.031108		
Equation 3	0.049087	0.030945		
Equation 4	0	-0.000001		
Equation 5	-0.35667	-0.133861		
Equation 6	0	-0.000006		
Equation 7	0	0		
Avg of Error	0.0837351	0.027988		

Conclusion

When the linear system has no one solution, it too difficult to solve using traditional methods, also using software based on these methods. Optimization software able to reach solutions to the system, with a difference in solutions. Lindo 6.1 has least error.

Recommendations

The study recommends introducing optimization software within the mathematics curriculum in the advanced stages of the educational system and training both the teachers as well as their students to use such software in order to reduce the time and effort required for solving traditional systems, and to obtain best results when solving these systems. It is recommended making use of information and communication technologies that made learning mathematics more easily and increase reliability on mathematical models in solving life problems.

Acknowledgements or Notes

We extend our thanks and gratitude to Professor Al-Ajab Mohammed Ismail for his valuable observations and guidance.

References

A. Barry (2003). Computational methods in O.R using Lindo and Lingo (2003). Available at: http://www.abarry.ws/books/CalculationMethodsBook.pdf/.

Bosch, W. W., and Strickland, J. (1998). Systems of linear equations on spreadsheet. Mathematics & Computer Education, 32, (1), 11-16

Deane Arganbright (n. d). Innovative Uses of Excel in Linear Algebra. Department of Mathematics and Computing Science Divine Word University, Papua New Guinea. Available online at: http://atcm. mathandtech. org/EP2011 /regular _papers / 3272011_19192.pdf.

El-Gebeily, M. and Yushau, B. (2008). Linear System of Equations, Matrix Inversion, and Linear Programming Using MS Excel. International Journal of Mathematical Education in Science and Technology, 39(1), 83-94.

Jerome, Lawrence (2012). Generalized assignment matrix methodology in linear programming. International Journal for Technology in Mathematics Education, v 19 n 1 p 25-41 2012.

LINDO User's Manual (2003). LINDO SYSTEMS INC. Available online at: http://www.lindo.com.

Mike Brookers (2011). The Matrix Reference Manual. Imperial College – London.

N. I. Danilina, N. S. Dubrovskaya, O. P. Kvasha and G. L. Samirov (1988). Computational Mathematics. Mir Publisher.

R. L. Burden and J. D. Faires (2011). Numerical Analysis (9th ed.).Youngstown State University.

Roanes-Lozano, Eugenio (2011). Some applications of algebraic system solving. International Journal for Technology in Mathematics Education; 2011, Vol. 18 Issue 3, p 149.

Yang, Der-Ching and Lin, Yung-Chi (2015). Examining the differences of linear systems between Finnish and Taiwanese textbooks. EURASIA Journal of Mathematics, Science & Technology Education, v11 n6 p1265-1281 Dec 2015.

Knowledge Levels of Teacher Candidates About Living Beings

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Abstract: As a first step of the study, a 30-item and three sub-dimension questionnaire- the general characteristics of the living creatures- was applied to the pre-service teachers. 411 pre-service teachers from various fields participated in the study. As a second step of the research, high school students from various class levels were selected and a 30-question questionnaire was applied to to 314 students from 9, 10, 11 and 12 grades.According to the results obtained from the survey, it has been revealed that secondary and university students' knowledge about the common characteristics of living things is incomplete, wrong and false.. Interestingly, the result of this study showed that the deficiencies, mistakes and errors are common in Secondary and University students. Based on the results of the study, it was concluded that pre-service teachers and secondary education students have very limited knowledge of living things, they cannot comprehend the common characteristics of living things sufficiently, they accept that the common characteristics of living things are mostly in animals and they do not accept that the same characteristics are also found in plants.Also, it was found that there were problems in the perceptions of teacher candidate sand secondary school students about the common characteristics of living plants and other living things, in their perceptions of thought. Based on the findings of this study, appropriate comments have been made to the results and appropriate suggestions have been developed to eliminate the misconceptions.

Keywords: Living things, Plants, Animals, Teacher candidates and elementary, Secondary school students

Ortaöğretim ve Yükseköğretim Öğrencileri Hangi Canlıları ve Canlılık Özelliklerini Tanıyor?

Özet: Araştırmanın birinci basamağı olarak öğretmen adaylarına üç alt boyuttan oluşmuş canlıların genel özelliklerini içeren 30 soruluk bir anket uygulanmıştır. Bu çalışmaya çeşitli alanlarda okuyan 411 Öğretmen adayı katılmıştır. Araştırmanın ikinci basamağı olarak çeşitli nitelikteki lise öğrencileri seçilmiş bunlara da öğretmen adaylarında olduğu gibi üç alt boyuttan oluşmuş canlıların genel özelliklerini içeren 30 soruluk bir anket uygulanmıştır. Bu çalışmaya da 3 farklı lise türünden 9., 10., 11. ve 12. sınıflarda okuyan 314 öğrenci katılmıştır.Anketten elde edilen sonuçlara göre Ortaokul (canlılara ait daha önceden yapılmış bir araştırma sonucudur), ortaöğretim ve Üniversite öğrencilerin canlıların ortak özellikleri hakkındaki bilgilerinin eksik, hatalı ve yanlışlar olduğu ortaya çıkmıştır. Bu çalışmada ilginç olarak ortaya çıkan sonuç ise eksik, hatalı ve yapılan yanlışların İlköğretim, Ortaöğretim ve Üniversite öğrencilerinde ortak olmasıdır. Araştırma sonucuna göre, öğretmen adaylarının, ortaöğretim ve ilköğretim öğrencilerinin canlılar ilgili bilgi dağarcıklarının oldukça kısıtlı olduğu, canlıların ortak özelliklerini yeterince doğru olarak kavrayamadıkları, canlıların ortak özelliklerinin büyük oranda hayvanlarda bulunduklarını kabul ederken aynı özelliklerin ise bitkilerde de bulunduğunu kabul etmedikleri sonucuna ulaşılmıştır. Öğretmen adaylarının, ortaöğretim ve ilköğretim öğrencilerinin hayvanlar dışındaki bitkilerin ve diğer canlıların, canlılığın ortak özellikleri konusunda düşünce dünyalarındaki algılamalarında sorunlar olduğu bulgularda öne çıkmıştır. Bu çalışmanın bulgularına dayalı olarak sonuçlara uygun yorumlar yapılmış ve bu konudaki yanılgıların ortadan kaldırılması için uygun öneriler geliştirilmeye çalışılmıştır.

Anahtar Kelimeler: Canlılar, Bitkiler, Hayvanlar, Öğretmen adayları ve ilköğretim, Ortaöğretim öğrencileri

Giriş

Yeryüzünde insanların canlılarla olan ilişkileri yaklaşık olarak insanın varoluşu ile başlamıştır. İnsanlar; başta beslenme olmak üzere korunma, ısınma, savunma ve hastalıklardan korunmak için bitkilerden; gücünden, etinden, sütünden, derisinden vb. özelliklerinden dolayı hayvanlardan yararlanmıştır.

Günümüze geldiğimizde ise insanların canlılarla olan ilişkilerinin önemi daha da artmış ve canlıların varlığı özellikle bitki ve hayvanlar temelinde daha da önem kazanmış ve okul programlarına alınmıştır. Bunun amacı, dünyanın günümüzdeki en büyük sorunu olan çevre sorunlarına karşı çevre dostu bireyler yetiştirerek biyolojik çeşitliliğin korunmasına katkı sağlamaktır (Erten, 2004a; 2004b).

Bilindiği gibi biyotik ve abiyotik faktörlerin (canlı ve cansız varlıkların) birbirleriyle denge içerisinde bulundukları ortama çevre denir. Biyotik ve abiyotik faktörlerin birbirleriyle olan dengesini bozan olumsuz faktörlerin tümüne ise çevre sorunları denir (Erten, 2000; Erten,2012). Tanımda yer alan biyotik faktörler canlılar âlemini abiyotik faktörler de cansız varlıkları içermektedir. Öğrencilere bunlar arasındaki ilişkiler kazandırılmalıdır. Bunun için özellikle öğrencilerin canlılar hakkındaki algılarının ortaya konması ve canlıları kendi düşünce dünyalarında nasıl ve ne derece doğru algıladıklarını ortaya koymak gerekmektedir. Bunların yanı sıra dünyadaki biyolojik çeşitliliğin sorunları da ele alınmalıdır.

Biyolojik çeşitlilik canlı doğanın tipik bir özelliğidir. Biyolojik çeşitlilik kavramı, biyolojide ekonomide ve politikada gün geçtikçe artan bir değere sahiptir. Biyolojik çeşitliliğin korunması ve sürdürülebilir kullanımı Rio sözleşmesinde de "biyolojik çeşitliliğin korunması" olarak yerini almıştır. Biyolojik çeşitliliğe hükümetlerin, iş dünyasının, araştırma ve eğitim kurumlarının ellerinden gelen desteği sağlamaları önerilmiştir (Bundesministerium für Umwelt, Natur und Reaktorsicherheit, 1997; T.C. Çevre Bakanlığı; Şahin ve Sert, 2018).

Günümüzde insanlık tarihinin en büyük sorunlarından biri olarak görülen çevre sorunlarının, özellikle küresel ısınmanın sebebinin insanlar olduğu IPCC (Bağımsız Uluslararası İklim Değişikliği Komisyonu) toplantısında kayıt altına alınmıştır. Komisyon raporuna göre; son 20 yılda küresel ısınmanın ana sebeplerinin başında insan etkinlikleri geldiği dile getirilmiştir (Sciama, 2007). Birleşmiş milletler çevre komisyonu başkanı Achim Steiner, bu günün tarihte insanların iklimlerin değişmesi üzerinde etkisinin açıklandığı gün olarak ele alınacağını açıklamıştır (Erten ve Aydoğdu,2011).

Okul programlarının, biyolojik çeşitliliğin çocuklar ve gençler tarafından nasıl öğrenileceğini, bu konuya nasıl motive olacaklarını, bireysel sorumluluklarını nasıl kazanacaklarını ve toplumsal biyolojik çeşitlilik bilincinin nasıl kazandırılacağını ele almasıyla da bu konuya katkı sağlamak durumundadır.

Çevre sorunlarından en önemlisi de biyolojik çeşitliliğin gün geçtikçe zarara uğratılması ve günden güne canlı çeşitliliğinin azalması, buna bağlı olarak da birçok canlının neslinin tehdit altında olmasıdır. Canlıların korunmasının gerekliliğinin birçok bilim insan tarafından ortaya konması ve çevre sözleşmelerinde yer alması konunun önemini göstermektedir (Erten, 2004a, 2015a, Bundesministerium für Umwelt, Natur und Reaktorsicherheit,1997).

Canlıların korunmasında canlılara karşı ilginin arttırılması ve öğretim programlarında bu konunun yer alması büyük önem arz etmektedir. Araştırmalara göre canlı ve cansız varlıkları korumak için çocukların küçük yaştan itibaren canlılarla ilgilenmesi, bakımlarını yapması, koruması, besleyip büyütmesi ve en azından okullarda bitki yetiştirmesi önerilmektedir. Öğrencilerin bunları yapabilmeleri için de canlıları tanımaları, canlı ve cansız varlıkların birbirleriyle olan dengeli ilişkilerini öğrenmeleri gerekir. Öğrenciler bu ilişkileri öğrenirse canlılarla ilgilenir böylece öğrencilerde canlılara karşı sevgi oluşmaya başlar ve canlılara değer vermeye başlar. İnsanlar da ancak sevdiklerini ve değer verdiklerini korudukları için doğadaki canlıları da korumaya başlayacaktır (Erten, 2004; Erten, 2015a, 2015b).

Bu güne kadar yapılan birçok araştırmada ilköğretimden yükseköğretime kadar sürdürülen eğitim ve öğretimde öğrencilerin canlıları yeterince tanımadıkları ve canlılar içerisinde yer alan canlı gruplarını tanımadıkları ve özellikle canlı gruplarından bitkiler konusundaki bilgilerin yetersiz olduğu ve bitkiler konusunda kavram yanılgılarının olduğunu gösteren çeşitli çalışmalar vardır (Doğan,2018; Keleş ve Özenoğlu, 2017, Oğuz ve Akyol, 2006; Türkmen ve arkadaşları, 2003; Bahar vd. 2002; Özsevgeç vd. 2007).

Ancak bu çalışmanın ana konusunu canlıların genel özelliklerini öğrencilerin diğer canlılara transfer etmede yaşadığı sorunlar oluşturmaktadır. Alan yazında da bu konu ile ilgili doğrudan araştırmalara ulaşılamamıştır.

Bu güne kadar üniversitedeki derslerimden edindiğim deneyimler sayesinde öğrencilerimin büyük çoğunluğunun canlılar ve canlıların genel özellikleri konularında bilgilerinin yetersiz olduğunu, canlıların ve canlı gruplarına ait genel özelliklerinde kavram yanılgılarının bulunduğunu tespit etmem, bu konuda bir araştırmanın yapılmasının gerekliliğini ortaya koymuştur. Bu sorunun nedenini ve öğrencilerin bu eksiklerini üniversite öncesi eğitim-öğretim dönemlerinden getirdiklerini ortaya koymak bu araştırmanın amacını oluşturmuştur. Bu soruna bir çözüm getirebilmek için bu çalışma planlanmıştır.

Yöntem

Araştırma, üniversite öğrencileri ve lisede okuyan öğrenciler olmak üzere iki farklı eğitim kademesindeki öğrencilerle yapılmıştır. Araştırmaya farklı sınıflardan fen bilgisi öğretmenliği (133 kişi), Matematik Öğretmenliği (67 kişi), Okulöncesi öğretmenliği (97 kişi) Sınıf öğretmenliği (114 kişi) anabilim dallarından

411 öğrenci katılmıştır. Araştırmaya liselerden, 3 farklı lise türü öğrencileri katılmıştır. Bunlar Sağlık Bilimleri Lisesi, Fen Lisesi ve Sosyal Bilimler lisesidir. Çalışmaya 9., 10., 11., ve 12. sınıflarda okuyan gönüllü 314 öğrenci katılmıştır.

Araştırmada veri toplama aracı olarak anket kullanılmıştır. Söz konusu anket Doğan (2018) tarafından yüksek lisans tezi hazırlanırken geliştirilen canlıların özellikleriyle ilgili bir veri toplama aracıdır. Anket; anket geliştirme basamakları uygulanarak, pilot uygulamasından geçirilerek geliştirilmiş, güvenilirliği ve geçerliliği hesaplanmıştır.

Öğrencilerin, hayvanları ve bitkileri düşünce dünyalarında algılamalarını ortaya koymak için önce canlıların genel özellikleri 10 madde altında hazırlanmıştır. Daha sonra bu maddeler canlıların en yaygın olarak tanınan hayvanlar ve bitkiler grubunda belirtilen maddelere uyarlanmıştır. Ankette bulunan önermelerden birkaçı örnek olarak şu şekildedir. "Canlılar kendilerine benzeyen bireyler oluştururlar", "Hayvanlar kendilerine benzeyen bireyler oluştururlar" ve "Bitkiler kendilerine benzeyen bireyler oluştururlar". Anket 5'li likert tipinde olup "Hiç katılmıyorum, Katılmıyorum, Fikrim Yok, Katılıyorum, Tamamen katılıyorum" ölçeklidir. (Anketin orijinali 2 ölçeklidir ama bu çalışma için anket 5 ölçekli hale getirilmiştir. Çünkü genelde ölçekler ölçme teknikleri açısından 5'li ya da 7'li olması önerilmektedir). Anketin orijinalinde araştırmacı tarafından verilen alfa güvenirlik katsayısı olarak α .65 verilmiştir. Araştırmacı bu güvenirlik katsayısının uygunluğunu şu kaynakça ile desteklemiştir. "Snavely bu değerin benzer maddelerden oluşan testlerde yeterli olabileceğini ifade etmektedir (2012, p. 35)". Bu araştırmada ise anketin alfa güvenlik katsayısı α.89 olarak bulunmuştur.

Toplanan veriler SPSS programına girilmiş bitkiler, hayvanlar ve canlılar öznesi altında toplanan bu grupların özellikleri birbirinin aynısı olması gerekirken farklı farklı cevaplar verilip verilmediği analiz edilmeye çalışılmıştır.

Gerekli istatistiki hesaplamalar yapılmıştır. Bu hesaplamalarda öncelikle genel ortalamalara bakılmıştır. Bu ortalamalara göre öğrencilerin en çok doğru olarak bildikleri ve aynı zamanda en az bildikleri konular ortaya çıkarılmış, eğitim kademeleri arası ve aynı eğitim kademesindeki gruplar arasındaki farklara bakılmış ve cinsiyetler arası farklar ile sınıflar arası farkların olup olmadığına bakılmıştır.

Bulgular

Aşağıdaki tablolardan da görüleceği gibi araştırmaya katılan 4 bölüm öğretmen adaylarının ortalamaları genel anlamda yüksektir. Bunların içerisinde en yüksek ortalama Fen Bilgisi öğretmen adaylarının olmasına karşılık diğer öğretmen adaylarının puanlarının da Fen Bilgisi öğretmen adaylarının puanlarına yakın olduğu görülmektedir. Sadece Okul öncesi öğretmen adaylarıyla Fen Bilgisi öğretmen adaylarının arasında istatistiki olarak Fen bilgisi öğretmen adaylarının lehine anlamlı fark vardır. Okulöncesi öğretmen adayları canlılar arasındaki farkları tanımada diğer öğretmen adaylarından biraz daha düşüktür. Bunun nedeni Fen Bilgisi öğretmen adaylarının programlarının gereği olarak Okulöncesi öğretmen adaylarına oranla canlılarla daha çok yoğun ilgilenmelerinden olabilir.

Tablo 1: 4 Bölüm Öğretmen adaylarının anketteki cevaplarının ortalamaları

Bölüm	Katılımcı Sayısı	Ortalama
FBÖ	133	125,80
İMÖ	67	124,06
OKL	97	120,29
İSÖ	114	123,10

Tablo 2'ye bakacak olursak; farklı 4 bölümde okuyan öğretmen adaylarının anketten aldıkları ortalamaları en küçükten en büyüğe doğru sıraladığımızda en düşük olarak değerlendirilen maddeler aynı zamanda en az bilinen konular olarak karşımıza çıktığını görürüz. Örneğin ankette 7. sırada yer alan **"Canlılarda besin taşınımı söz konusudur"** önermesi 4 bölüm öğrencileri tarafından da en çok yanlış yapılan önerme olarak karşımıza çıkmaktadır. **" Bitkiler enerji kazanmak için besin tüketir"** önermesi de 4 bölüm öğrencileri tarafından 2. sırada en çok yanlış yapılan kavram yanılgısıdır.

Diğer yandan Fen Bilgisi ve Okulöncesi öğretmen adayları tarafından canlılar hakkında en iyi bilinenlerden birisi de Ankette 15. sırada yer alan **"Hayvanlar solunum yapar"** ve 16. sırada yer alan **"Hayvanlar enerji kazanmak için besin tüketir"** önermesidir. Matematik ve Sınıf öğretmenliği tarafından en çok bilinen önerme ise **"Hayvanlar enerji kazanmak için besin tüketir."**

Fen bilgisi, matematik, okulöncesi ve sınıf öğretmenliği okuyan öğretmen adaylarının canlıları tanıma konusunda verdikleri cevapların ortalamalarında istatistiki olarak anlamlı farklar ortaya çıkmamıştır.
Aynı sonuçlarda cinsiyete dayalı farkların olup olmadığına bakıldığında da kadın öğretmen adaylarında aynı sonuçlar görülmüştür. Bu durum normal karşılanmıştır. Çünkü 4 bölüm öğretmen adayları içerisinde erkek popülasyonu çok azdır. Bundan dolayı cinsiyete dayalı fark yoktur. Bu sonuçlar, başka araştırmalarla desteklenmedikçe bu araştırma ile sınırlı kalacaktır.

Tablo 2. Öğretmen adaylarının ankette en olumsuz ve en olumlu olarak cevap verdikleri konular

FBÖ		İMÖ		OKL		İSÖ	
3.62	s7	3.4	s7	3.41	s7	3.51	7. Canlılarda besin taşınımı söz konusudur.
3.69	s26	3.78	s28	3.54	s26	3.59	26. Bitkiler enerji kazanmak için besin tüketir.
3.7	s1	3.84	s8	3.56	s1	3.77	
3.74	s4	3.84	s26	3.56	s28	3.85	
3.92	s6	3.84	s5	3.69	s6	3.87	
3.97	s11	3.88	s27	3.7	s8	3.89	
…….	…….	…….	…….	…….	…….	…….	…….
4.58	s18	4.54	s16	4.54	s15	4.49	16. Hayvanlar enerji kazanmak için besin tüketir. FBÖ-OKL
4.62	s20	4.6	s15	4.6	s18	4.49	15. Hayvanlar solunum yapar. FBÖ-OKL
4.63	s15	4.61	s20	4.6	s20	4.57	20. Hayvanlar ihtiyaçlarını karışılmak için uygun alanlar seçer. İMÖ -S15

Fen bilgisi, Matematik, Okulöncesi ve Sınıf öğretmenliği öğretmen adayları ankette yer alan canlılarla ilgili önermelere verdikleri cevaplardan canlıların genel özelliklerinin hayvan ve bitkilerde de bulunacağına genel anlamda katıldıkları görülmektedir. Ancak bazı özellikler konusunda bilgilerinin eksik olduğu ortaya çıkmaktadır. Örneğin söz konusu 4 bölüm öğretmen adaylarının ortaklaşa en düşük değerlendirdikleri önerme "canlılarda besin taşınımı söz konusudur" önermesi olmuştur. Öğretmen adayları bu önermeyi "fikrim yok" temelinde değerlendirmişlerdir. Diğer bir eksik oldukları konu ise 2. sıradaki "Bitkiler enerji kazanmak için besin tüketir" önermesidir. 3. sırada "canlılarda erkek ve dişi üreme hücreleri bulunur" daha sonra "canlılar enerji kazanmak için besin tüketir" önermesini "fikrim yok ile katılıyorum" arasında değerlendirerek bu konularda yanlış bilgilere sahip olduklarını göstermişlerdir.

4 bölüm öğretmen adaylarının anketteki sorulara verdikleri cevaplar değerlendirildiğinde katılımcıların ortalamalarından hareket ederek katılımcıların ortalamaları 5'li derecelendirme üzerinden 3 ile 4 arasında yer aldığı görülüyor fakat hangi konuları yüzde kaçı bilmiyor bunu öğrenmek için öğretmen adaylarının ve lise öğrencilerinin genel dağılım tablosundan konuları bilmeme yüzdeleri tablo 3'de verilmiştir. En az bilinmeyenden en çok bilinmeyene doğru sıralanmıştır. Örneğin tablodaki ilk 10 önerme en az yanlış bilinen konulardır. Başka bir deyişle bu maddeleri araştırmaya katılan öğretmen adaylarının % 90'ı, lise öğrencilerinin yaklaşık % 80'i doğru bilmektedir. Tablonun sonundaki konu ise araştırmaya katılan öğrenciler tarafından en çok yanlış yapılan konu olarak karşımıza çıkmaktadır. Örneğin "Canlılarda besin taşınımı söz konusudur." Önermesini öğretmen adaylarının yaklaşık %50'si, lise öğrencilerinin %56'sı yanlış bilmekte ya da hiç bilmemektedir.

Tablo 3. Farklı bölümdeki öğretmen adayları ve 3 farklı lise türünde okuyan öğrencilerin canlılar, hayvanlar ve bitkilerin canlılık özelliklerinin en az bilinmeyenden en çok bilinmeyene doğru sıralanışı ve yüzdeliklerini gösteren tablo

	FBÖ, İMÖ, İSÖ ve OKL Öğretmen Adaylarının Konuları Bilmeme Yüzdeleri	**%Lise Öğrencileri (SBL, SOSBL ve Şen Lisesi)**
Hayvanlar ihtiyaçlarını karışılmak için uygun alanlar seçer.	% 1,7	%12,7
Hayvanlar solunum yapar.	%1,9	%10,5
Hayvanlar mikroplardan etkilenerek hasta olabilirler.	%4,1	%17,5
Hayvanlar çevreden gelen etkilere tepki verir.	%4,4	%16,2
Hayvanlar enerji kazanmak için besin tüketir.	%4,6	%15

Canlılar ihtiyaçlarını karşılamak için uygun alanlar seçer.	%5,8	%9,9
Hayvanlarda genetik bozukluklar olabilir.	%6,1	%21,3
Hayvanların farklı görevleri yapan organları bulunur.	%6,1	%23,2
Hayvanlar kendilerine benzeyen bireyler oluşturur.	%9	%22,9
Canlılar kendilerine benzeyen bireyler oluşturur.	*%11,4*	*%19,4*
Bitkiler solunum yapar.	%13,4	%28,7
Bitkiler ihtiyaçlarını karşılamak için uygun alan seçer.	%15,8	%31,2
Bitkilerin farklı görevler yapan organları bulunur.	%16,1	%31,9
Bitkiler kendilerine benzeyen bireyler oluşturur	%19,5	%32,25
Canlıların farklı görevler yapan organları bulunur.	%20,4	%21,7
Hayvanlarda erkek ve dişi üreme hücreleri bulunur.	%21,2	%19,7
Canlılar solunum yapar.	%23,1	%19,7
Canlılar enerji kazanmak için besin tüketir.	%23,1	%20,7
Bitkilerde besin taşınımı söz konusudur.	%23,6	%50,3
Bitkilerde erkek ve dişi üreme hücreleri bulunur.	%23,8	%33,1
Canlılarda erkek ve dişi üreme hücreleri bulunur.	%24,1	%22,6
Canlılar mikroplardan etkilenerek hasta olabilirler.	%24,1	%27,7
Hayvanlarda besin taşınımı söz konusudur.	%24,3	%38,9
Bitkilerde genetik bozukluk olabilir	%24,3	%39,8
Canlılarda genetik bozukluklar olabilir.	%24,6	%34,1
Bitkiler çevreden gelen etkilere tepki verir.	%24,6	%42,7
Bitkiler mikroplardan etkilenerek hasta olabilirler.	%24,6	%46,1
Canlılar çevreden gelen etkilere tepki verir.	%25,3	25,8
Bitkiler enerji kazanmak için besin tüketir.	%35,5	40,4
Canlılarda besin taşınımı söz konusudur.	%47,2	%56,4

Dört Bölüm öğretmen adaylarının sonuçlarına baktığımızda; Tüm öğretmen adaylarının madde bazında konuyu bilmeme ya da yanlış bilme yüzdelikleri en düşükten en yükseğe sıralandığında oluşan tablodan da görüldüğü gibi öğretmen adaylarımızın hangi konularda yanılgıları olduğu veya konuları bilmedikleri açıkça görülmektedir. Bu tabloda yüzdeliği en az olan konu öğretmen adayları tarafından en iyi bilinen konu olarak karşımıza çıkmaktadır. Örneğin 1. 2. ve 3. sıradaki "Hayvanlar ihtiyaçlarını karşılamak için uygun alanlar seçerler", "Hayvanlar solunum yapar" ve "Hayvanlar mikroplardan etkilenerek hasta olabilirler". Bu konulardan 1.sıradaki % 1,7, 2. sıradaki %1,9 ve 3. sıradaki %4,1 öğretmen adayı tarafından hiç katılmıyorum, katılmıyorum ve bilmiyorum diye işaretlenmiştir. Yani bu 3 konu yaklaşık % 98,3, %98,1 ve %95,9 öğretmen adayı tarafından doğru olarak bilinmektedir.

Lise Öğrencileri (SBL, SOSBL ve Fen Lisesi) ile dört bölüm öğretmen adaylarının sonuçlarını kıyasladığımızda;

- Tablo 3'de bulunan lise öğrencilerinin sonuçları da hemen hemen öğretmen adaylarının sonuçlarıyla benzerlik göstermektedir. Örneğin lise öğrencilerinde 1., 2., 3.,4., 5. ve 6. sıradaki maddeler öğretmen adaylarındaki sıralamayla hemen hemen aynı sırada bulunmaktadır. Ancak öğrencilerde bu konuların bilinme yüzdesi öğretmen adaylarına göre biraz daha düşüktür. Örneğin "Hayvanlar ihtiyaçlarını karışılmak için uygun alanlar seçer" öğretmenlerin olumsuz cevap verme yüzdesi %1,7 iken öğrencilerde %12,7'dir.

- Tablo 3'den diğer maddelere de bakacak olursak canlıların özelliklerini tanıma ve doğru bilme yüzdeleri öğrencilere göre öğretmen adaylarında daha yüksektir. Her iki grupta benzer olan ise canlıların en iyi bilinen özellikleri hemen hemen ilk 10 maddede en az bilinenlerinin ise son 10 maddede bulunmasıdır. Bu gruplaşmanın da aynı konuları içermesi sorunun ortaokul (Bkz. Tablo 5), ortaöğretim-, ve yükseköğretimde aynı olduğunu göstermesi açısından çok ilginçtir. Bu sonuçların canlıların ortak özelliklerinin öğretimi konusunda sorun olabileceğini bize göstermektedir.

- Bir başka ilginç sonuç tabloda ilk 10'a giren maddelerde hemen hemen hayvanların özelliklerinin ortaya çıkmış olmasıdır. Kısacası öğretmen adaylarının ve öğrencilerin en iyi bildikleri ve tanıdıkları canlı grubu hayvanlar olarak görülmektedir. Aynı zamanda Öğretmen adaylarının ve öğrencilerin canlılık özelliklerini en iyi uyarladıkları canlılar da hayvanlar olarak görülüyor.

- Buna karşın listenin en sonunda yer alan aşağıdaki 6 önerme de (Anket maddesi) öğretmen adayları ve lise öğrencileri tarafından en az bilinen konular olarak ortaya çıkmıştır. Tablo 4'de ortaya çıkan sonuçlar, öğretmen adaylarının yaklaşık %25'i ile %50'si (Ortalama olarak %35'i) ve öğrencilerin yaklaşık %25'i ile %56'sı (Ortalama olarak %43,55'i) özellikle bitkilerin canlılık özelliklerini yanlış bildiklerini ortaya koymaktadır. Örneğin öğretmen adaylarının %47,2'sinin ve lise öğrencilerinin %56,4'ünün "Canlılarda besin taşınımı söz konusudur." ifadesine hiç katılmadıklarını, katılmadıklarını veya bilmediklerini ortaya koymaktadır.

- Lise öğrencilerinin %50'si ise "Bitkilerde besin taşınımı söz konusudur." ifadesine olumsuz yanıt vererek hem canlıların hem de bitkilerin besin taşımadıklarına inanmaktadırlar. "Hayvanlarda besin taşınımı söz konusudur." ifadesine ise öğretmen adayları %24.3, lise öğrencileri %38.9 oranında olumsuz yanıt vermişlerdir. Genel anlamda canlıların genel özelliklerinden olan besin taşınımı yani beslenmeleri en az bilinen bir özellik olarak ortaya çıkmaktadır.

- Tablo 3 incelendiğinde öğretmen adayları ve öğrencilerin en çok bildikleri canlı özellikleri tablonun başındaki 10 maddede yer almaktadır. Bunların da hemen hemen hepsi hayvanlarla ilgilidir. En çok bilinen ve tanınanlar içerisinde bitkilerle ilgili hiçbir madde yer almamaktadır. Tablo 5 incelendiğinde ise tablo 4'deki sıralamada en son sırada yer alan 6 maddenin öğretmen adayları ve öğrencilerin en çok yanlış yaptıkları veya en az bildikleri canlılık özellikleri bulunmaktadır. Bunların da hemen hepsi bitkilerdir. Öğretmen adayları ve öğrenciler tarafından canlıların ortak özellikleri en çok hayvanlarda sonra canlılarda bilinirken en az da bitkilerde bilinmektedir.

Tablo 4. Öğretmen adayları ve lise öğrencileri tarafından en çok katılmadıkları son 6 madde ve yüzdeleleri

Anket Maddeleri	**FBÖ, İMÖ, İSÖ ve OKL Öğretmen Adaylarının Konuları Bilmeme Yüzdeleri**	**Lise Öğrencileri (SBL, SOSBL ve Fen Lisesi)**
Bitkilerde besin taşınımı söz konusudur.	%23,6	%50,3
Bitkiler çevrenden gelen etkilere tepki verir.	%24,6	**%**42,7
Bitkiler mikroplardan etkilenerek hasta olabilirler.	%24,6	**%**46,1
Canlılar çevreden gelen etkilere tepki verir.	%25,3	**%**25,8
Bitkiler enerji kazanmak için besin tüketir.	%35,5	**%**40,4
Canlılarda besin taşınımı söz konusudur.	%47,2	**%**56,4

Bu sonuçlarla ilgili olarak ortaokulda yapılan bir çalışmayı da burada ele almak yararlı olacaktır. Bu konu ile ilgili aşağıdaki tabloda Doğan'ın (2018) yaptığı araştırma sonuçları görülmektedir. Bu araştırmada yer alan öğrenciler ise ortaokul öğrencileridir. Tablodan da görüldüğü gibi öğrencilerin canlıların canlılık özeliklerinin bitkilerde bulunabilirliğini oldukça düşük olarak algılamaktadırlar. Örneğin aşağıdaki tabloda 5. sıradaki "Canlılar solunum yapar" ifadesine %77, Hayvanlar solunum yapar ifadesine %87 ama "Bitkiler solunum yapar" ifadesine sadece %23 öğrenci evet katılıyorum demiştir. Örneğin canlıların genel özelliklerinden olan üremeyi içeren "genellikle canlılarda erkek ve dişi üreme hücreleri bulunur" ifadesine öğrencilerin %77'si evet katılıyorum derken %23'ü hayır katılmıyorum demiştir. Aynı maddeyi hayvan ve bitkiler için sorduğumuzda öğrencilerin %71'i evet, %29'u hayır derken, bitkiler için öğrencilerin %37'si Evet %63'ü hayır demişlerdir.

Öğrencilerin her 3 maddeye de yaklaşık aynı cevabı vermeleri beklenirken, öğrencilerin %63'ü bitkileri canlılar kategorisine almadıkları görülmektedir.

Tablo 5. Ortaokul öğrencilerinin canlılar, hayvanlar ve bitkilerin özelliklerini bilme oranları

Hayvanlar ve Bitkiler sütunu için önermeler Hayvanlar ve Bitkiler diye başlıyor	CANLILAR	HAYVANLAR	BİTKİLER
	EVET	EVET	EVET
1. Canlılarda erkek ve dişi üreme hücreleri bulunur.	%77	%71	%37
2. Canlılar kendilerine benzeyen bireyler oluştururlar.	%72	%64	%52
3. Canlılarda genetik bozukluklar olabilir.	%80	%72	%51
4. Canlıların şarklı görevler yapan organları bulunur.	%79	%71	%46
5. Canlılar solunum yapar.	%77	%87	%23
6. Canlılar enerji kazanmak için besin tüketir.	%91	%87	%52
7. Canlılarda besin taşıyan dolaşım sıvısı bulunur.	%62	%62	%39
8. Canlılar çevreden gelen etkilere tepki verir.	%83	%83	%45
9. Canlılar mikroplardan etkilenerek hasta olabilirler.	%88	%84	%47
10. Canlılar ihtiyaçlarını karşılamak için uygun alanlar seçerler.	%87	%81	%47

Buradan çıkan sonuç ortaokul öğrencilerinin %77'si bitkilerin solunum yapmadığını düşünüyor. Eğer öğrenciler bitkilerin canlılardan olduğunu bilselerdi bitkilerin de bu özelliği taşıdıklarının farkında olacaklardı. Diğer cevaplara da bakacak olursak öğrencilerin yaklaşık %50'si bitkilerde canlıların genel özelliklerinin bulunacağını bilmiyorlar ve dolayısıyla hayvanlar gibi görmüyorlar anlamı çıkmaktadır. Topsakal'ın ilkokul 4. sınıf öğrencilerinde yaptığı bir araştırmaya göre öğrencilerin %33,3'ü "Bitkiler canlı değildir." demişlerdir. Bu ve buna benzer literatürlerdeki diğer çalışmaların bulguları ile bu çalışmadaki bulgular birbirini desteklemektedir. Canlıların ortak özelliklerini araştırmaya katılan öğretmen adayları ve lise öğrencilerinin canlıların ortak özelliklerini niçin bitkilere transfer etmede sorunlar yaşamakta olduklarının cevabı olabilecektir.

Sonuçlar ve Yorumlar

Araştırma sonucuna göre ortaya çıkan sonuçlardan hem ilkokulda, hem ortaöğretimde hem de yükseköğretimde okuyan öğrenciler canlıların ortak özelliklerini düşünce dünyalarında algılamalarında sorunlar olduğu görülmektedir. Canlıların ortak özellikleri demek, tüm canlılarda olan özellik demek olduğu halde, söz konusu öğrenciler bu özelliklerin bazı canlılarda olduğunu bazı canlılarda olmadığını düşünmektedir. Öğrencilerin okullarda bu konuyu tam olarak öğrenmemeleri canlılarla ilgili düşünce dünyalarındaki çelişkili algılamalarının nedeni olarak gözükmektedir. Bu konuların öğrenciler tarafından öğrenilememiş olmasının en önemli sebeplerden birisi ülkemizdeki sınav odaklı eğitim ve dolayısıyla derslerde ezbere dayalı ele alınan bilgilerdir. Bu sonuç hem gözlemlerimden hem de literatürdeki (Türkmen ve arkadaşları, 2003; Bahar vd. 2002; Özsevgeç vd. 2007) birçok araştırmadan malumumuzdur. Sonuçlar bize, öğrencilerin bu konuları öğrenemediklerini, derinlemesine düşünme becerileri kazanamadıklarını, çıkarsama becerilerine sahip olmadıklarını, tümdengelim ve tümevarım yetilerini de kullanamadıklarını göstermektedir. Araştırmalar, öğrencilerin bitkilerin hareket eden canlılar olmayışı nedeniyle düşünce dünyalarında kavram yanılgıları olduğunu ortaya koymaktadır. (Keleş ve Özenoğlu, 2017, Oğuz ve Akyol, 2006; Türkmen ve arkadaşları, 2003; Bahar vd. 2002; Özsevgeç vd. 2007). Bu yanlış algıların ortadan kalkabilmesi için literatürdeki öneriler şu şekildedir:

- ✓ Öğretmen tarafından geliştirilen materyallerde veya
- ✓ etkinliklerde matris bulmaca,
- ✓ yapılandırılmış grid,
- ✓ ilginç resim veya karikatür
- ✓ kavram haritası vb. gibi alternatif yöntem ve tekniklerin kullanılmasıdır.(Topsakal, 2009)

Öğrencilerin Canlıları ve Canlılık Özelliklerini Öğrenmedeki Sorunları Gidermedeki Yardımcı Bulgu Ve Sonuçlara Dayalı Öneriler

1. Dünyada özellikle Avrupa ülkelerinde canlıların, bitkilerin ve hayvanların derslerde kullanılması yeni olmamakla birlikte, ülkemizde okullarda canlı materyallerin derslere dâhil edilmesi yaygın bir davranış olarak gözükmemektedir. Canlı materyallerin derslere dâhil edilmesiyle özellikle ilköğretimde ve ortaöğretimde öğrencilerin canlılara olan motivasyonları artmakta ve canlılara yönelik pozitif tutumlar gelişmektedir. Özellikle öğrencilerin hayvan ve bitkilerle ilgilenmeleri burada önemli bir rol oynamaktadır.

2. Araştırmalar, derslerin duyuşsal hedeflerine ulaşmada derslere canlı organizmaları dâhil etme kadar etkili başka bir aracın düşünülemeyeceğini ortaya koymuştur. Canlı bitki ve hayvanların okul ortamına alınması rastgele olamaz. Öğretmen hangi hayvanın veya bitkinin hangi amaca hizmet edeceğini tam olarak belirleyerek bu işi yapmak zorundadır. Çocukların zarar göreceği veya çocukların zarar vereceği hayvan ve bitkiler okul ortamına alınmamalıdır.

3. Almanya'da okulların %65'ine yakınında derslerde canlılar ders materyali olarak kullanılmakta ve öğretmenlerin %52'si biyoloji ve fen derslerinde canlılarla ders işlemenin kesinlikle gerekli olduğunu ve %42'si de sadece gerekli değil aynı zamanda da pedagojik yönden çok faydalı olduğunu belirtmişlerdir (Eschenhagen vd.,1998). Birçok araştırmada çocukların bitkilerden ziyade hayvanlara ilgi duydukları görülmektedir. Bunun nedeni olarak hayvanların hareket etmesi, davranışların izlenmesi ve gözlenebilir olmasıdır. Hayvanların davranışları çocuklara ilginç geldiğinden çocukların hayvanlarla duygusal anlamda bağ kurmalarına neden olmaktadır. Bu duygusal bağlar sevgiye dönüşür, sevgi de korumayı öğretir. Bu da bitki ve hayvanlara karşı çocukların empati kurmasını sağlar. Bu özellikler ise çevre dostu bireylerin oluşmasında rol oynayan temel faktörler olup sürdürülebilir eğitimin kendisidir (Eschenhagen vd.,1998, Berck ve Klee, 1992, Erten,S. 2004)).

4. Her öğrenci mümkün olduğunca biyoloji ve fen alanındaki bilgilerini doğrudan gözlenebilen canlılardan kazanmalıdırlar. Günümüzde birçok insan çevre ve canlılarla ilgili yaşantılarını ancak teknik araç- gereçlerle yani yapay ortalardan (kitaplar, resimler, televizyon, internet vb.) sağlamaktadır. Gräsel'e göre, eğer bilgi yapay birtakım ortamlarda kazanılmış ise, bu durumda bu bilgiden gerçek ve karmaşık durumlarda yararlanmak pek mümkün olamaz.

5. Canlı türlerine olan ilgi, birçok insanda canlılara karşı koruyucu tutumların gelişmesine neden olmakta (scherf, 1986) ve çevre dostu davranışların gelişmesine sebep olmaktadır.

6. Canlılarla yoğun olarak ilgilenen kişilerin bu davranışlarının kaynağının ne olduğu sorulduğunda verdikleri cevaplar çocukken doğada yaptıkları gezintiler ve çocukluklarında doğadaki yaşantıları olduğunu açıklamışlardır (Berck ve Klee, 1992). Bundan dolayı öğretmenler derslerini planlarken gezileri de içine alan planlar yapmalı eğer bu da gerçekleşmiyorsa öğrencilerini canlı gruplarıyla ilgilenmelerini sağlamalıdır.

7. Canlı bitki ve hayvanların derslerde veya okullarda kullanılmasının önemi, Johann Amos Comenius zamanından yani yaklaşık 300 yıldan beri vurgulanmaktadır. İlköğretimde canlı objelerle ilgilenme öğrencilerin canlılara ve fen eğitimine karşı olan öğrenme isteklerini arttırır, canlılara karşı ilgileri, ilgiler de pozitif tutumları geliştirir.(Staeck, 1980, 40; Wenske, 1981; Gehlhaar, 1994b).

8. Yeni Fen Bilimleri programında 6. sınıf fen bilimleri dersinde kurbağaların gelişimlerinden örnekler verilmesi tavsiye edilmektedir. Fakat kurbağaların gelişimlerinin nasıl olduğu konusunda ve bunların nasıl gözlenebileceği konusunda bir açıklama yapılmamıştır. Kurbağaların sınıfta ders materyali olarak nasıl kullanılabileceğini Erten'in yaptığı çalışma yararlı olacaktır.(Erten, 2015c).

9. Bulgularda bitki ve hayvanlarla ilgilenme değişkenlerinin genel çevre bilinci puanlarının yordayıcısı olarak ortaya çıkması, bunun ne kadar gerekli olduğunu ortaya koymaktadır. Çevrenin korunması, çevrede bulunan canlıların korunmasıyla eşdeğerdir. Öğretmenler derslerinde canlılara karşı öğrencilerin ilgilerinin arttırılması, canlılara karşı empatinin geliştirilmesi ve canlılara karşı çocuklarda oluşmuş olan nefret ve tiksintinin yerine canlılara karşı sevginin geliştirilmesi konusunda çaba göstermelidirler (Erten, 2015; 2015b). Hayvanları kötüleyen, onları bir canavar gibi gösteren, onlardan nefret ettiren ve tiksindiren masallar, hikâyeler, şiirler ve şarkıların (örn, Kırmızı Şapkalı Kız Hikâyesi, Elimizde Baltalar Şarkısı vb.) öğretmenler tarafından kreşlerde, ilk ve ortaöğretimde ve hatta lisans eğitiminde ele alınmasından uzak durulmalıdır. Öğretmenler derslerinde canlılara karşı ilgi ve sevgiyi aşılamalıdır. Çünkü ilgi sevgiyi, sevgi de korumayı öğretir, insanlar da ancak sevdiklerini korur.

10. Oğuz ve Akyol (2006), çağdaş eğitim yaklaşımlar içerisinde yer alan ve birçok okul öncesi eğitim kurumunda kullanılan Montessori yaklaşımını ele aldıkları bir makalede bu eğitim yaklaşımında canlılar konusunun önemini şu ifadelerle vurgulamışlardır. "Doğanın önemli bir parçası olan gerçek bitki ve hayvanların

yetiştirilmesi ve her türlü bakımları bir Montessori programında çocuğun günlük temel etkinlikleri içinde yer alır."

11. Son olarak da öğretmenlerin öğretim ilkelerini derslerinde titizlikle ele almaları, derslerini daha kalıcı, yaparak ve yaşayarak öğretmek için dikkate alması gereken ilkeleri bilmeleri, öğrencilerin bu ilkelerden tümdengelim ve tümevarım ile düşünme becerilerinden olan çıkarsama becerilerini öğrencilere kazandırmak ilk işleri olmalıdır.

Kaynakça

Bahar, M., Cihangir, S. ve Gözün, Ö. (2002, Eylül). Okul Öncesi ve İlköğretim Çağındaki Öğrencilerin Canlı ve Cansız Nesneler İle İlgili Alternatif Düşünce Kalıpları. V. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresinde sunulmuş bildiri, ODTÜ, Ankara

Berck, K-H. & Klee, R. (1992). *Interesse an Tier- und Pflanzenarten und Handeln im Naturschutz.* Frankfurt am Main. Peter Lang.

Bundesministerium Şür Umwelt, Natur Und Reaktorsicherheit (1997). Umweltpolitik Agenda 21, Konşerenz Der Vereinigten Nationen Şür Umwelt Und Entwicklung İn Juni 1992 İn Rio De Janeiro – Dokumente – Bonn

Doğan, F.G. (2018). Ortaokul Öğrencilerinde Bitkilerin Canlı Olarak Algılanma Düzeylerinin Araştırılması. Yüksek Lisans Tezi Matematik ve Fen Bilimleri Eğitimi Anabilim Dalı Gazi Üniversitesi Eğitim Bilimleri Enstitüsü

Erten, S. (2004a). Uluslararası Düzeyde Yükselen Bir Değer Olarak Biyolojik Çeşitlilik. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi 27 : [2004] 98-105

Erten, S. (2015). Üniversite Öğrencilerindeki Çevreyi Korumaya Yönelik İlgilerde Kimin ve Neyin Etkisi Olmaktadır? Pau Egit Fak Derg, 2015 (38): 157-167

Erten, S. (2000). Empirische Untersuchungen zu Bedingungen der Umwelterziehung –ein interkulturellervergleich auf der Grundlage der Theorie des geplanten Verhaltens. Tectum Verlag. Marburg.

Erten, S. (2012) Türk ve Azeri Öğretmen Adaylarında Çevre Bilinci.Environmental Consciousness among Turkish and Azeri Candidate. Eğitim ve Bilim 2012, Cilt 37, Sayı 166.

Erten, S. (2015a). Biyolojik çeşitlilik ve sürdürülebilir eğitim için örnek ders materyali. International journal of education in mathematics, science and technology. Volume 3, number 2, April 2015, page 155-161

Erten, S. (2015b). Interests of 5th Through 10th Grade Students Regarding Enviromental Protection Issues. International Journal of Progressive Education, Volume 11 Number 1.

Erten, S. (2015c). Sample Course Material for Biodiversity And Sustainable Education. *International Journal Oş Education in Mathematics, Science And Technology*, *3*(2), 155-161

Erten, S. ve Aydoğdu, C. (2011).Türkiyeli ve Azerbaycanlı Öğrencilerde, Ekosentrik, Antroposentrik Ve Çevreye Karşı Antipatik Tutum Anlayışları. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi 41: 158-169

Erten, S. (2004b): Çevre Eğitimi Ve Çevre Bilinci Nedir, Çevre Eğitimi Nasıl Olmalıdır?, Çevre ve İnsan Dergisi, Çevre ve Orman Bakanlığı Yayın Organı. Sayı 65/66. 2006/25 Ankara

Eschenhagen, D., Kattmann, U. & Rodi, D. (1998). *Fachdidaktik Biologie*. Köln: Aulis

Gräsel, C. (1997): "Problemorientiertes Lernen". Göttingen, Bem, Toronto, Seattle

Keleş, T. ve Özenoğlu, H. (2017). Ortaokul Öğrencileri İçin Biyolojik Çeşitlilik Konusunda Ders Planı Tasarlama. Adnan Menderes Üniversitesi Eğitim Fakültesi Eğitim Bilimleri Dergisi, Aralık 2017, 8(2), 41-65. Http://Dergi.Adu.Edu.Tr/Egitimbilimleri/

Oğuz, V., Akyol, A. K. (2006) Çocuk Eğitiminde Montessori Yaklaşımı. *Ç.Ü. Sosyal Bilimler Enstitüsü Dergisi, Cilt 15, Sayı 1, S.243-256*

Özsevgeç, T. , Salih çepni, S. ve Bayri, N. (2007). Kalıcı Kavramsal Değişimde 5E Modelinin Etkililiği. Yeditepe eğitim Fakültesi Dergisi, Cilt 2, Sayı 2, 1-17.

Şahin, Ü. G. ve Sert, H.(2018). İlköğretim Öğrencilerinin Biyoçeşitlilik Konusundaki Farkındalıklarının İncelenmesi. Kastamonu Education Journal. Volume:26 Issue:3

Sciama; Y. (2007). Klimaeraermung: Es ist höchste Zeit. Resarch-eu, Magazin des Europaischen Forschungsraums Nr. 52 Europaischen Komission.

Staeck, L. (1980). Arbeiten mit dem lebenden Objekt im Biologieunterricht. *NiU 20 (1972a), H. 3, 128-133.*

T.C. Çevre Bakanlığı (Basım Tarihi Yok) Birleşmiş Milletler Çevre Ve Kalkınma Konşeransı, Gündem 21, Orman Prensipleri, Ankara

T.T.K.D. (Türkiye Tabiatını Koruma Derneği) (2001). *Biyolojik Çeşitlilik ve Çevre Koruma Rehberi,* Ankara.

Topsakal, U. Ü. (2009). Tematik Öğretimin Canlı ve Cansız Varlıklarla İlgili Kavram Yanılgılarının Giderilmesinde Etkililiği. Sakarya Üniversitesi Eğitim Fakültesi Dergisi, 17, s. 219-234.

Türkmen, L., Dikmenli, M. ve Çardak, O. (2003. İlköğretim Öğrencilerinin Bitkiler Hakkındaki Alternatiş Kavramları. Aşyon Kocatepe Üniversitesi Sosyal Bilimler Dergisi Cilt 5, Sayı 2.

Wenske, E. (1981). Unterrichtsmittel mit Naturobjekten. *BioS 30, H. 6, 239-244.*

Wilson, E.O (1992). *Ende der biologischen Vielfalt. Verlust an Arten, Genen und Lebensräumen und die Chancen für eine Umkehr*. Spektrum, Heidelberg.

The Comparison of 2013 and 2017 Science Curriculum for the Gains of Environmental Science

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Abstract: The environment in which biotic and abiotic factors interact with each other in a balanced manner is called the environment. Biotic factors expressed here include living things, while abiotic factors include inanimate ones. Environmental factors are all factors that negatively affect the balanced interaction of biotic and abiotic factors with each other. Environmental education in the education and training of the individuals is effective in stopping environmental problems. The concept of environmental education is a tool used to educate individuals with environmental awareness. Aims in environmental awareness; having environmental knowledge and showing positive attitudes and behaviors towards the environment. The aim of the research in this context is to compare the achievements related to environmental science gains in the 3rd, 4th, 5th, 6th, 7th and 8th grades of the 2013 and 2017 Science Curriculum. In the method of the research, a document review (content analysis) which is one of the qualitative research methods was performed. As a result of the survey, the number of gains related to environmental science increased in the 3rd (from 6 to 9), 5th (from 2 to 4) and 8th grade levels (from 5 to 8) 10'a) and 7th grade (from 7 to 5). At the 6th grade level, the number of gains remains unchanged and remains at 6 gains. In the classes where the numbers are increased, the contents of some gains have been changed and new achievements not included in the 2013 curriculum have been added to the 2017 curriculum.

Keywords: Environmental science, Science curriculum, Environmental science gains, Science literacy

2013 ve 2017 Fen Bilimleri Öğretim Programlarının Çevre Bilimi Kazanımları Açısından İncelenmesi

Özet: Bu araştırmanın amacı, 2013 ve 2017 Fen Bilimleri Öğretim Programında 3, 4, 5, 6, 7 ve 8.sınıflarda yer alan çevre bilimi ile ilgili kazanımların karşılaştırılmasıdır. Araştırmanın yönteminde nitel araştırma yöntemlerinden olan doküman incelemesi (içerik analizi) yapılmıştır. İçerik analizinde 2013 ve 2017 Fen Bilimleri Öğretim Programlarında farklı sınıf seviyelerinde (3, 4, 5, 6, 7. ve 8.sınıflar) yer alan çevre bilimi kazanımları tek tek incelenerek karşılaştırılmıştır. Eklenen veya çıkarılan kazanımların neler olduğu tespit edilmiştir. Elde edilen veriler tablolaştırılarak sunulmuştur. Araştırmanın kapsamını 2013 Fen Bilimleri Öğretim Programı ile 2017 yılında hazırlanmış olan ve 2018-2019 eğitim öğretim yılında tamamen tüm sınıflarda uygulanmaya başlanan Fen Bilimleri Öğretim Programı'nda yer alan çevre bilimi kazanımları oluşturmaktadır. Araştırmanın sonucunda 3. (6'dan 9'a), 5. (2'den 4'e) ve 8.sınıf seviyelerinde (5'ten 8'e) çevre bilimi ile ilgili kazanım sayıları artarken, 4. (13'ten 10'a) ve 7. sınıf seviyelerinde (7'den 5'e) kazanım sayıları azalmıştır. 6. sınıf seviyesinde ise kazanım sayısı değişmemiş ve 6 kazanım olarak kalmıştır. Sayılarında artış görülen sınıflarda bazı kazanımların içeriği değiştirilmiş ve 2013 öğretim programında olmayan yeni kazanımlar, 2017 öğretim programına eklenmiştir.

Anahtar Kelimeler: Çevre bilimi, Fen bilimleri Öğretim programları, Çevre bilimi kazanımları, Fen okuryazarlığı

Giriş

Biyotik ve abiyotik faktörlerin birbirleriyle dengeli bir biçimde etkileşimde bulundukları ortama çevre denir. Burada ifade edilen biyotik faktörler canlılar âlemini içerirken abiyotik faktörler ise cansız varlıkları içermektedir. Biyotik ve abiyotik faktörlerin birbirleriyle dengeli bir biçimde etkileşimini olumsuz yönde etkileyen faktörlerin hepsine ise çevre sorunları denir. İnsanoğlunun ortaya çıkışı ile gün geçtikçe artan çevre sorunlarını durdurabilmenin yolu, çevre dostu davranış gösterebilen bireylerin yetiştirilmesi ile mümkün olabilecektir. Bu konuda bireylerin eğitim ve öğretim hayatında aldıkları çevre eğitimi etkili olmaktadır. Erten (2012)'e göre çevre eğitimi kavramı, çevre bilincine sahip, çevre dostu davranışlar gösteren bireyleri yetiştirmede kullanılan bir araçtır. Çevre bilincinde amaçlanan hedeflerin; çevre bilgisine sahip, çevreye yönelik olumlu tutum ve davranış gösteren bireyler yetişmesinin olduğu ifade edilmektedir (Erten, 2005).

Çevre bilinci kavramının üç temel hedefi bulunmaktadır. Bu hedefler: çevre bilgisine sahip olmak, çevreye karşı olumlu tutum göstermek ve çevreye faydalı davranışlarda bulunmaktır. Bu hedefler Erten (2005) tarafından aşağıdaki şekilde açıklanmaktadır:

Çevre bilgisi: Çevre sorunları, çevre sorunları için aranan çözüm yolları, farklı ekolojik alanlarda yaşanan gelişmeler ile doğaya ait bilgilerin tümüdür.

Çevreye yönelik tutumlar: Çevre sorunlarından dolayı ortaya çıkan olumsuzluklar (korkular, huzursuzluklar vb.), değer yargıları ve çevre sorunlarının çözülmesi için kişilerin sahip olduğu hazır bulunuşluğu vb. durumlarda bireylerin çevre için faydalı davranışlar doğrultusunda pozitif veya negatif olarak gösterdiği tavır ve düşüncelerdir.

Çevreye yararlı davranışlar: Çevreyi korumak amacıyla çevre dostu bireylerin gerçekleştirdiği davranışlardır.
Temiz ve sürdürülebilir çevre için toplumun bilinçli hale gelebilmesi, sürdürülebilir çevrenin ne olduğunun bilinmesi ve çevre bilincinin kazandırılması için bu konuda eğitim verilmesi önemlidir (Güneş, Alat & Gözüm, 2013). Çevre eğitimi özellikle çocuklara verilmeli ve bu konuda çocuklar gerekli bilgi, tutum, davranış için eğitilmelidir. Çünkü insanlar, yaşadıkları yerlerin işleyişini ve bu alanlara yaptıkları olumlu-olumsuz tüm etkileri öğrendikçe, çevreye karşı daha duyarlı ve daha farkında olarak hareket ederler (Güler, 2009). Ülkemizde ilköğretim çağlarında başlayan çevre eğitimi sonrasında ortaöğretim ondan sonra da üniversite ile devam etmektedir (Kaya, Akıllı & Sezek, 2009). Ayrıca ülkemizde çevre için verilen eğitim, hem formal hem de informal şekilde sürdürülmektedir. Buna ek olarak örgün eğitimde çevre eğitimi Milli Eğitim Bakanlığı'nın hazırladığı eğitim programları çerçevesinde hayat bilgisi, sosyal bilgiler ve fen bilimleri derslerinde işlenmektedir (Özcan, 2016).

Geçmişten günümüze doğru geçen sürede yaşanan gelişmeler, birçok değişim yaşanmasına sebep olmuştur. Bu değişimler fen alanındaki gelişmeleri de kapsamaktadır. Bu yüzden bu alanda öğrenen bireyler için yaşadığı dönemdeki teknolojiyle başa çıkabilme, eleştirel anlamda düşünme vb. farklı özellikleri kazanma gerekliliğini ortaya koymuştur (Taşçi & Yılmaz-Soylu, 2015). Bu tür özellikleri kazanmak için ise bireylerin eğitim alması gerekmektedir. Okullarda ise bu eğitimin örgün kısmı uygulanmaktadır. Örgün eğitim faaliyetleri, belirlenmiş olan plan ve program çerçevesinde gerçekleştirilmektedir. Bu yüzden öğretim programının verimli ve etkili olması, verilen eğitim ve öğretimin de o denli verimli ve etkili olmasını sağlamaktadır (Aykaç, Küçük, Kartal, Tilkibaş & Keskin, 2011). İçinde bulunulan dönemle uyumlu ve fen okuryazarı bireyler yetiştirmek için fen bilimleri dersi öğretim programlarında, fen okuryazarlığına dair bütün boyutların uygun şekilde bulunması gerekmektedir. Bu sebeple fen bilimleri öğretim programı kapsamında yer alan kazanımların fen okuryazarlığı yönünden de ne şekilde bir dağılıma sahip olduğunun belirlenmesi önem arz etmektedir (Yılmaz, Öner-Sünkür & İlhan, 2012).

Ülkelerin ilerlemesinde ve ekonomik olarak ilerlemesinde fen eğitiminin yeri büyüktür. Bu sebeple Türkiye'de verilen fen eğitiminin gelişmesini sağlayarak daha verimli hale getirmek için çalışılmaktadır. Bununla birlikte fen dersleri için büyük önem arz eden öğretim programları da döneme uygun şekilde devamlı değiştirilmektedir. Gün geçtikçe bilimde ortaya çıkan gelişmeler, birçok konudaki bilgi miktarında artış sağlamaktadır. Bilimsel alanda ortaya çıkan yeni bilgiler okullarda verilen eğitim sürecinde de birçok değişime sebep olmakta ve öğretim programlarının sürekli değişmesini gerekli kılmaktadır (Ersoy, 2000'den akt: Aykaç, Küçük, Kartal, Tilkibaş & Keskin, 2011). Bilimsel alanda yaşanan gelişmelere ve artan bilgilere ek olarak öğretim programlarının uygulanması sırasında ortaya çıkan sorunlar veya eksiklikler de programların değişmesinde rol oynamaktadır (Aykaç, Küçük, Kartal, Tilkibaş & Keskin, 2011). Bu tür nedenlerden dolayı fen bilimleri öğretim programlarında değişimler ve yenilikler meydana gelmiştir. Öğretim programlarına yönelik yapılan geliştirme ve yenileme çalışmaları 2000 yılından itibaren beş kere yapılmıştır. Bu yenileme ve geliştirme çalışmaları 2002, 2004, 2013, 2017 ve 2018 yıllarında yapılmıştır (Özer, Erdaş-Kartal, Doğan, Çakmakçı, İrez & Yalaki, 2018). Bu bağlamda 2013 Fen Bilimleri Öğretim Programı'nın çevre alanı ile ilgili özel amaçları ve 2017 Fen Bilimleri Öğretim Programı'nın çevre alanı ile ilgili özel amaçları aşağıdaki gibidir:

2013 Fen Bilimleri Öğretim Programı Çevre ile İlgili Özel Amaçları

1. Biyoloji, Fizik, Kimya, Yer, Gök ve *Çevre Bilimleri,* Sağlık ve Doğal Afetler hakkında temel bilgiler kazandırmak,
2. *Doğanın keşfedilmesi ve insan-çevre arasındaki ilişkinin anlaşılması* sürecinde, bilimsel süreç becerilerini ve bilimsel araştırma yaklaşımını benimseyip karşılaşılan sorunlara çözüm üretmek,
4. *Birey, çevre ve toplum arasındaki* karşılıklı etkileşimi fark etmek ve toplum, ekonomi, doğal kaynaklara ilişkin *sürdürülebilir kalkınma bilincini geliştirmek*,

9. Bilimin, teknolojinin gelişmesi, toplumsal sorunların çözümü ve *doğal çevredeki ilişkilerin anlaşılmasına* olan katkısını takdir etmeyi sağlamak (MEB, 2013).

2017 Fen Bilimleri Öğretim Programı Çevre ile İlgili Özel Amaçları

1. Astronomi, biyoloji, fizik, kimya, yer ve *çevre bilimleri* ile fen ve mühendislik uygulamaları hakkında *temel bilgiler kazandırmak*,
2. *Doğanın keşfedilmesi ve insan-çevre arasındaki ilişkinin anlaşılması* sürecinde, bilimsel süreç becerileri ve bilimsel araştırma yaklaşımını benimseyip bu alanlarda karşılaşılan sorunlara çözüm üretmek,
3. *Birey, çevre ve toplum arasındaki karşılıklı etkileşimi fark ettirmek*; toplum, ekonomi ve doğal kaynaklara ilişkin *sürdürülebilir kalkınma bilincini geliştirmek* (MEB, 2018).

Fen bilimleri öğretim programlarında bu kadar önemli yeri olan ve yaşamı bu denli büyük ölçüde etkileyen; çevre bilimi, çevre bilinci, insan-çevre ilişkisi gibi başlıkların çatısını oluşturan çevre kavramı ile ilgili kazanımların araştırılması da çok önemlidir. Ayrıca yapılan literatür taraması sonucunda çevre alanı ile ilgili 2013 ve 2017 fen bilimleri öğretim programında bir araştırma yapılmadığı tespit edilmiş olup, bu çalışmanın bu konuda önem arz ettiği düşünülmektedir.

Yöntem

Araştırmanın yönteminde nitel araştırma yöntemlerinden olan doküman incelemesi (içerik analizi) yapılmıştır. İçerik analizinde 2013 ve 2017 Fen Bilimleri Öğretim Programlarında farklı sınıf seviyelerinde (3, 4, 5, 6, 7. ve 8.sınıflar) yer alan çevre bilimi kazanımları tek tek incelenerek karşılaştırılmıştır. Eklenen veya çıkarılan kazanımların neler olduğu tespit edilmiştir. Ayrıca kazanımlar incelenirken yıllara, öğrenme alanlarına, ünite isimlerine ve değişen ya da sabit kalan kazanım sayılarına göre gruplandırılarak daha net bir şablon üzerinden sonuçlara ulaşılmıştır. Araştırma sonucunda elde edilen veriler tablolaştırılarak sunulmuştur. Araştırmanın kapsamını 2013 Fen Bilimleri Öğretim Programı ile 2017 yılında hazırlanmış olan ve 2018-2019 eğitim öğretim yılında tamamen tüm sınıflarda uygulanmaya başlanan 2017 Fen Bilimleri Öğretim Programı'nda yer alan çevre bilimi kazanımları oluşturmaktadır.

Bulgular ve Tartışma

3. Sınıf Kazanımlarına Ait Bulgular

Tablo 1. 3. Sınıf canlılar dünyasına yolculuk öğrenme alanına ait kazanımların değişim tablosu

Yıl	**Öğrenme Alanı**	**Ünite Adı**				
		Çevremizdeki Varlıkları Tanıyalım	*Ben ve Çevrem*	*Doğal ve Yapay Çevre*	*Bilinçli Tüketici*	**Toplam**
2017	Canlılar Dünyasına Yolculuk	2 kazanım	6 kazanım	-	-	8 kazanım
2013	Canlılar Dünyasına Yolculuk	1 kazanım	1 kazanım	2 kazanım	1 kazanım	5 kazanım

3.sınıfların *Canlılar Dünyasına Yolculuk* öğrenme alanında yer alan bölümler incelendiğinde 2013 yılında 5 kazanım yer alırken 2017 yılında bu alana ait kazanım sayısı 8 kazanıma çıkmıştır. 2013 yılında "Çevremizdeki Varlıkları Tanıyalım", "Ben ve Çevrem", "Doğal ve Yapay Çevre" ile "Bilinçli Tüketici" üniteleri yer alırken 2017 yılında bu ünitelerden sadece "Çevremizdeki Varlıkları Tanıyalım" ünitesi ile "Ben ve Çevrem" ünitesi yer almıştır. Ünite sayısının 2017 yılında azalmasına rağmen kazanım sayısının arttığı yani mevcut ünitelerinin kapsamının genişletildiği tespit edilmiştir.

Tablo 2. 3. Sınıf elektrikli araçlar/ yaşamımızdaki elektrikli araçlar öğrenme alanına ait kazanımların değişim tablosu

Yıl	**Öğrenme Alanı**	**Ünite Adı**	
		Elektrik Kaynakları	**Toplam**
2017	Elektrikli Araçlar	1 kazanım	1 kazanım
2013	Yaşamımızdaki Elektrikli Araçlar	1 kazanım	1 kazanım

3.sınıfın 2013 ve 2017 yıllarına göre farklı öğrenme alanları içerisinde yer alan *Elektrik Kaynakları* bölümüne ait kazanım sayısı her iki yılda da değişmemiş ve 1 kazanım olarak sabit kalmıştır. Ayrıca kazanımın içeriğinin de değişmeden kaldığı tespit edilmiş olup sadece 2017 öğretim programında öğrenme alanının adının değiştirildiği belirlenmiştir.

4. Sınıf Kazanımlarına Ait Bulgular

Tablo 3. 4. Sınıf aydınlatma ve ses teknolojileri/ geçmişten günümüze aydınlatma ve ses teknolojileri öğrenme alanına ait kazanımların değişim tablosu

Yıl	**Öğrenme Alanı**	**Ünite Adı**			
		Uygun Aydınlatma	*Işık Kirliliği*	*Ses Kirliliği*	**Toplam**
2017	Aydınlatma ve Ses Teknolojileri	2 kazanım	3 kazanım	3 kazanım	8 kazanım
2013	Geçmişten Günümüze Aydınlatma ve Ses Teknolojileri	3 kazanım	3 kazanım	3 kazanım	9 kazanım

4.sınıflarda 2013 yılında *Geçmişten Günümüze Aydınlatma ve Ses Teknolojileri* adında ve yılında ise 2017 *Aydınlatma ve Ses Teknolojileri* adında farklı öğrenme alanları içerisinde yer alan bölümlere ait kazanımlar 2013 yılında 9 tane iken 2017 yılında 8 kazanıma düşmüştür. Ünitelerin adında bir değişiklik olmamasına rağmen "Uygun Aydınlatma" ünitesinde 2013 yılında yer alan "*Uygun aydınlatmanın göz sağlığı açısından önemi vurgulanır."* kazanımı, 2017 yılında ilk kazanımın alt maddesi olarak ifade edilmiştir.

Tablo 4. 4. Sınıf insan ve çevre/ mikroskobik canlılar ve çevremiz öğrenme alanına ait kazanımların değişim tablosu

Yıl	**Öğrenme Alanı**	**Ünite Adı**		
		Bilinçli Tüketici	*İnsan ve Çevre İlişkisi*	**Toplam**
2017	İnsan ve Çevre	2 kazanım	-	2 kazanım
2013	Mikroskobik Canlılar ve Çevremiz	-	4 kazanım	4 kazanım

4.sınıflarda 2013 yılında *Mikroskobik Canlılar ve Çevremiz* ve 2017 yılında ise *İnsan ve Çevre* öğrenme alanları içerisinde ve farklı ünite isimleri ile ifade edilen kazanımlar 2013 yılında 4 kazanım iken 2017 yılında ise 2 kazanıma düşmüştür. Kazanımların içerikleri de değişmiştir.

5. Sınıf Kazanımlarına Ait Bulgular

Tablo 5. 5. Sınıf insan ve çevre/ canlılar dünyasını gezelim ve tanıyalım öğrenme alanına ait kazanımların değişim tablosu

Yıl	**Öğrenme Alanı**	**Ünite Adı**	
		İnsan ve Çevre İlişkisi	**Toplam**
2017	İnsan ve Çevre	4 kazanım	4 kazanım
2013	Canlılar Dünyasını Gezelim ve Tanıyalım	2 kazanım	2 kazanım

5.sınıfın 2013 ve 2017 yıllarına göre farklı öğrenme alanları içerisinde yer alan "İnsan ve Çevre İlişkisi" ünitesine ait kazanım sayısı 2013 yılında 2 kazanım iken 2017 yılında bu sayı 4 kazanıma çıkmıştır. 2013 öğretim programında yer alan kazanımlarla 2017 yılındaki kazanımların benzerlikleri olduğu tespit edilmiştir. Fakat 2017 yılındaki öğretim programında "İnsan ve Çevre İlişkisi" ünitesi daha kapsamlı hale getirilerek konu genişletilmiştir.

6. Sınıf Kazanımlarına Ait Bulgular

Tablo 6. 6. Sınıf madde ve ısı öğrenme alanına ait kazanımların değişim tablosu

Yıl	**Öğrenme Alanı**	**Ünite Adı**		
		Madde ve Isı	*Yakıtlar*	**Toplam**
2017	Madde ve Isı	3 kazanım	3 kazanım	6 kazanım
2013	Madde ve Isı	3 kazanım	3 kazanım	6 kazanım

6.sınıfların *Madde ve Isı* öğrenme alanında yer alan bölümler incelendiğinde "Madde ve Isı" ünitesinin kazanımları 2013 ve 2017 yılında 3 kazanım olarak aynı şekilde ifade edilmiştir. "Yakıtlar" ünitesinin kazanım sayısı da aynı "Madde ve Isı" ünitesinde olduğu gibi hem sayı hem de içerik olarak değiştirilmemiş, 2013 ve 2017 yıllarında 3 kazanım olarak ifade edilmiştir.

7. Sınıf Kazanımlarına Ait Bulgular

Tablo 7. 7. Sınıf saf madde ve karışımlar/ maddenin yapısı ve özellikleri öğrenme alanına ait kazanımların değişim tablosu

Yıl	**Öğrenme Alanı**	**Ünite Adı**	
		Evsel Atıklar ve Geri Dönüşüm	**Toplam**
2017	Saf Madde ve Karışımlar	5 kazanım	5 kazanım
2013	Maddenin Yapısı ve Özellikleri	7 kazanım	7 kazanım

7.sınıflarda 2013 yılında *Maddenin Yapısı ve Özellikleri* öğrenme alanı, 2017 yılında ise *Saf Madde ve Kazanımlar* öğrenme alanı içerisinde ve farklı ünite isimleri ile ifade edilen "Evsel Atıklar ve Geri Dönüşüm" ünitesinin kazanımları 2013 yılında 7 kazanım iken 2017 yılında ise 5 kazanıma düşmüştür. Kazanım sayısı azalmış gibi görünse de geriye kalan iki kazanım, diğer kazanımlarla birleştirilmiştir. Yani kazanımların içeriği genişletilirken konunun kapsamında değişiklik olmamıştır.

8. Sınıf Kazanımlarına Ait Bulgular

Tablo 8. 8. Sınıf enerji dönüşümleri ve çevre bilimi/ canlılar ve enerji ilişkileri öğrenme alanına ait kazanımların değişim tablosu

Yıl	Öğrenme Alanı	Ünite Adı		
		Madde Döngüleri ve Çevre Sorunları/ Madde Döngüleri	*Sürdürülebilir Kalkınma*	**Toplam**
2017	Enerji Dönüşümleri ve Çevre Bilimi	3 kazanım	5 kazanım	8 kazanım
2013	Canlılar ve Enerji İlişkileri	3 kazanım	2 kazanım	5 kazanım

8.sınıflarda 2013 yılında *Canlılar ve Enerji İlişkileri* ve 2017 yılında ise *Enerji Dönüşümleri ve Çevre Bilimi* öğrenme alanları içerisinde yer alan ve 2017 yılında "Madde Döngüleri ve Çevre Sorunları" olarak, 2013 yılında ise "Madde Döngüleri" ünitelerinde yer alan kazanımlar, 2013 ve 2017 yıllarında 3 kazanım olarak ifade edilmiştir. Fakat 2017 yılındaki öğretim programında yer alan "Madde Döngüleri ve Çevre Sorunları" ünitesinde üçüncü kazanımın alt kazanımları oldukça geniş olmakla birlikte çevre alanında öğrencilerin genel kültür ve genel yeteneklerini de genişletecek şekilde hazırlanmıştır. "Sürdürülebilir Kalkınma" ünitesine ait kazanımlar ise 2013 yılında 2 kazanım iken 2017 yılında ise 5 kazanıma çıkmıştır. Burada da kazanımların çerçevesi 2017 yılındaki öğretim programında genişletilmiştir.

Sonuç olarak 2013 Fen Bilimleri Öğretim Programı ile 2017 Fen Bilimleri Öğretim Programı'nda çevre bilimi ile ilgili kazanımlar karşılaştırıldığında 3., 5. ve 8.sınıflarda 2013 yılına göre 2017 yılında çevre kazanımlarının sayılarının arttığı, buna karşın 4., 6. ve 7.sınıfların çevre kazanım sayılarının 2013 yılına göre 2017 yılında azaldığı belirlenmiştir. Toplamda 2017 yılında kazanım sayısı, 2013 yılına kıyasla 2 kazanım artarak 42 kazanıma çıkmıştır. Bu ifadeyle ilgili bilgiler aşağıdaki tabloda yer almaktadır:

Tablo 9. 2013 Fen bilimleri öğretim programı ile 2017 fen bilimleri öğretim programı'nda yer alan kazanımların sayısal olarak karşılaştırılması

	3.sınıf	4.sınıf	5.sınıf	6.sınıf	7.sınıf	8.sınıf	Toplam
2013	6 kazanım	13 kazanım	2 kazanım	7 kazanım	7 kazanım	5 kazanım	40 kazanım
2017	9 kazanım	10 kazanım	4 kazanım	6 kazanım	5 kazanım	8 kazanım	42 kazanım

Ayrıca kazanım sayısı farklı sınıfların bazı ünitelerinde azalmış gibi görünse de 2017 yılı öğretim programında yer alan bazı kazanımların içerikleri genişletilmiş ve 2013 yılı öğretim programındaki kazanımlarla eş değer içerikte olacak şekilde hazırlandığı tespit edilmiştir.

Sonuç ve Öneriler

Araştırma kapsamında yer alan 2013 Fen Bilimleri Öğretim Programı ile 2017 Fen Bilimleri Öğretim Programı'nın çevre bilimi ile ilgili kazanımlarının karşılaştırılması sonucunda bazı yerlerde farklılıkların olduğu bazı yerlerde ise benzerliklerin olduğu tespit edilmiştir. Farklılık, var olan kazanımların yeni programda olmaması ya da olmayan kazanımların yeni programa eklenmesi; benzerlik ise var olan kazanımların başka bir kazanımla birleştirilmesi ya da eski programdaki bazı kazanımların yeni programdaki kazanımların alt kazanımı şeklinde yer alması olarak belirtilmektedir. Ayrıca 3. sınıf (6'dan 9'a), 5. sınıf (2'den 4'e) ve 8.sınıf seviyelerinde (5'ten 8'e) çevre bilimi ile ilgili kazanım sayıları artmıştır. 4. sınıf (13'ten 10'a) ve 7. sınıf seviyelerinde (7'den 5'e) kazanım sayıları azalmıştır. 6. sınıf seviyesinde ise kazanım sayısı değişmemiş ve 6 kazanım olarak kalmıştır. Sayılarında artış görülen sınıflarda bazı kazanımların içeriği değiştirilmiş ve 2013 öğretim programında olmayan yeni kazanımlar, 2017 öğretim programına eklenmiştir. Bu durum, Deveci (2018) tarafından yapılan araştırma sonucunu da desteklemektedir. Deveci (2018) yaptığı çalışmasında 2013 ve 2018 Fen Bilimleri Öğretim Programlarını temel ögeler açısından farklı yönlerden karşılaştırmıştır. Programların kazanım açısından karşılaştırılması sonucunda 2018 yılı öğretim programında kazanım sayısının, 2013 öğretim programına kıyasla azalış gösterdiğini tespit etmiştir. Bunlara ek olarak bazı kavramların öğrenciye anlatılma seviyesinin değiştirildiği bazı kavramlara ait kazanımların da programdan kaldırıldığını belirlemiştir.

Kaynakça

Aykaç, N., Küçük, H., Kartal, M., Tilkibaş, Ş., Keskin, G. (2011). Türkiye Cumhuriyeti'nin Kuruluşundan Günümüze 4. ve 5. Sınıf Fen Öğretim Programlarının Öğretim Programının Öğelerine Göre Değerlendirilmesi. İlköğretim Online, 10(3), s.824-835.

Deveci, İ. (2018). Türkiye'de 2013 ve 2018 Yılı Fen Bilimleri Dersi Öğretim Programlarının Temel Öğeler Açısından Karşılaştırılması. Mersin Üniversitesi Eğitim Fakültesi Dergisi, 14(2), s.799-825.

Erten, S. (2005). Okul Öncesi Öğretmen Adaylarında Çevre Dostu Davranışların Araştırılması. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 28*, s.91-100.

Erten, S. (2012). Türk ve Azeri Öğretmen Adaylarında Çevre Bilinci. *Eğitim ve Bilim, 37*(166).

Güler, T. (2009). Ekoloji Temelli Bir Çevre Eğitiminin Öğretmenlerin Çevre Eğitimine Karşı Görüşlerine Etkileri. *Eğitim ve Bilim, 34*(151).

Güneş, T., Alat, K., Gözüm, A, İ, C,. (2013). Fen Öğretmeni Adaylarına Yönelik Yenilenebilir Enerji Kaynakları Tutum Ölçeği: Geçerlilik ve Güvenirlik Çalışması. *Eğitim Bilimleri Araştırmaları Dergisi, 3*(2).

Kaya, E., Akıllı, M., Sezek, F. (2009). Lise Öğrencilerinin Çevreye Karşı Tutumlarının Cinsiyet Açısından İncelenmesi. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, 9*(18), s.43-54.

MEB (2013). *İlköğretim Kurumları (İlkokullar ve Ortaokullar) Fen Bilimleri Dersi (3,4,5,6,7 ve 8. Sınıflar) Öğretim Programı*. Milli Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı, Ankara.

MEB (2018). *İlköğretim Kurumları (İlkokul ve Ortaokul) Fen Bilimleri Dersi (3,4,5,6,7 ve 8. Sınıflar) Öğretim Programı*. Milli Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı, Ankara.

Özcan, E. (2016). İlkokul Öğrencilerinin Çevreye Yönelik Tutumlarının İncelenmesi. *Pamukkale Üniversitesi*, *Yüksek Lisans Tezi.*

Özer, F., Erdaş-Kartal, E., Doğan, N., Çakmakçı, G., İrez, S., Yalaki, Y. (2018). Öğretmen Mesleki Gelişim Programına Genel Bir Bakış: Model, Süreç, Engel, Teori ve Uygulama. Amasya Üniversitesi Eğitim Fakültesi Dergisi, 7(1), s.63-97.

Taşçi, G., Yılmaz-Soylu, M. (2015). Sınıf Öğretmenlerinin Fen Öğretim Programına Yönelik Görüşlerinin Biyoloji Konuları Bakımından Değerlendirilmesi: Erzincan Örneği. Erzincan Üniversitesi Eğitim Fakültesi Dergisi, 17(1), s.55-72.

Yılmaz, F., Öner-Sünkür, M., İlhan, M. (2012). İlköğretim Fen ve Teknoloji Dersi Öğretim Programında Yer Alan Fiziksel Olaylar Öğrenme Alanına Ait Kazanımlar İle Fizik Dersi Öğretim Programı Kazanımlarının Fen Okuryazarlığı Açısından Karşılaştırılması. İlköğretim Online, 11(4), s.915-926.

A Study on the Relationship between Nomophobia and Virtual Environment Loneliness

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Abstract: Developments in mobile communication technologies have led mobile phones to be rapidly adopted across the whole world. While mobility of smart phones offer obvious benefits in meeting individuals' basic needs, it also brings some new problems. One of these problems is called nomophobia, which is defined as fear of being deprived of smart phones or mobile internet. The purpose of this study was to investigate the relationships between nomophobia and virtual environment loneliness of various participants (university students, employees and housewives). In addition, the study explored whether or not the participants' nomophobia and virtual environment loneliness varied by their genders, professions and daily smart phone use durations. 352 individuals in total living in a large city in central Turkey participated in the study on a voluntary basis. The research data were collected using "Nomophobia Scale" and "Virtual Environment Loneliness Scale". Descriptive analyses, correlation analysis, independent samples t test analysis and one-way variance analysis were used to analyze the data collected within the scope of this study, which was conducted in accordance with the procedures of relational survey model and causal-comparative research. According to the findings of the study, nomophobia of the participants were above average for the following three sub-dimensions; in not being able to access information, not being able to communicate and losing connectedness, but below average in giving up convenience sub-dimension. Virtual environment loneliness of the participants, on the other hand, was found to be above average the following two sub-dimensions in virtual socialization and virtual loneliness, but below average in virtual sharing sub-dimension. It was found that the participants' nomophobia and virtual environment loneliness were positively and significantly correlated except for giving up convenience and virtual loneliness sub-dimensions. According to another finding of the study, female participants were generally found to be more nomophobic than male participants, but no significant difference was observed between female and male participants in virtual environment loneliness in terms of gender. In addition, it was found that in general students were more nomophobic and felt themselves lonelier in the virtual environment when compared with employees and housewives. Finally, it was found that as the duration of daily smart phone use increased, the participants became more nomophobic and felt lonelier in the virtual environment.

Keywords: Nomophobia, Virtual environment loneliness, Smart phone

Nomofobi ile Sanal Ortam Yalnızlığı Arasındaki İlişkinin İncelenmesi

Özet: Mobil bilgi ve iletişim teknolojisindeki gelişmeler tüm dünyada mobil telefonların hızla benimsenmesine yol açmıştır. Akıllı telefonların mobilitesi bireylerin temel ihtiyaçlarını karşılamada belirgin faydalar sağlarken, akıllı telefon kullanımıyla ilgili bazı problemleri de beraberinde getirmektedir. Bu problemlerden birisi de akıllı telefon veya mobil internetten mahrum kalma korkusu olarak tanımlanan nomofobidir. Bu araştırma ile farklı katılımcıların (üniversite öğrencileri, çalışanlar ve ev hanımları) nomofobileri ile sanal ortam yalnızlıkları arasındaki ilişkilerin incelenmesi amaçlanmıştır. Bununla birlikte araştırma kapsamında katılımcıların nomofobileri ile sanal ortam yalnızlıklarının cinsiyetlerine, mesleklerine ve günlük akıllı telefon kullanım sürelerine göre farklılaşıp farklılaşmadığı incelenmiştir. Araştırmaya Türkiye'nin orta kesimindeki büyük bir ilde yaşayan ve akıllı telefon kullanan toplam 352 kişi gönüllülük esasına göre katılmıştır. Araştırmanın verileri "Nomofobi Ölçeği" ve "Sanal Ortam Yalnızlık Ölçeği" aracılığıyla toplanmıştır. İlişkisel tarama ve nedensel karşılaştırma prosedürlerine uygun olarak yürütülen bu araştırmanın verilerinin analizinde betimsel istatistikler, korelasyon analizi, bağımsız örneklem t-testi analizi ve tek yönlü varyans analizi kullanılmıştır. Araştırmanın bulgularına göre, katılımcıların nomofobilerinin bilgiye erişememe, iletişim kuramama ve bağlantıyı kaybetme alt boyutlarında ortalamanın üzerinde oldukları, cihazdan yoksunluk alt boyutunda ise ortalamanın altında oldukları belirlenmiştir. Katılımcıların sanal ortam yalnızlıklarının ise, sanal sosyalleşme ve sanal yalnızlık alt boyutlarında ortalamanın üzerinde sanal paylaşım alt boyutunda ise ortalamanın altında oldukları tespit edilmiştir. Katılımcıların nomofobileri ile sanal ortam yalnızlıklarının cihazdan yoksunluk ve sanal yalnızlık alt boyutları hariç pozitif yönde ve anlamlı düzeyde ilişkili olduğu tespit edilmiştir. Çalışmanın bir diğer bulgusuna göre, genel olarak kadın katılımcıların erkek katılımcılara göre daha nomofobik olduğu görülürken, sanal ortam yalnızlığında cinsiyet açısından erkekler ile kadınlar arasında anlamlı bir fark bulunamamıştır. Bunun yanı sıra, genel olarak öğrencilerin, çalışan ve ev hanımlarına göre hem daha nomofobik hem de sanal ortamda kendilerini daha fazla yalnız hissettikleri ortaya çıkmıştır. Son olarak, günlük akıllı telefon kullanım süresi arttıkça katılımcıların hem daha fazla nomofobik olduğu hem de sanal ortamda kendilerini daha fazla yalnız hissettikleri belirlenmiştir.

Anahtar Kelimeler: Nomofobi, Sanal ortam yalnızlığı, Akıllı telefon.

Giriş

Mobil bilgi ve iletişim teknolojisindeki gelişmeler tüm dünyada mobil telefonların hızla benimsenmesine yol açmıştır. GSMA Intelligence (2018)'in verilerine göre tüm dünyada 8,5 milyar mobil telefon aboneliği ve yaklaşık 5 milyar mobil telefon kullanıcısı vardır. Ayrıca mobil telefon kullananların yaklaşık %80'ni akıllı telefon kullanmaktadır. Ülkemizde ise mobil telefon kullanıcı sayısı 2017 yılı sonu itibariyle 78 milyonu bulurken (ülke nüfusunun %96'sı) bunun 3.1 milyonu 2G, 10.3 milyonu 3G ve 64.6 milyonu da 4.5G teknolojisine sahip mobil telefon kullanıcısıdır (UDHB [Ulaştırma Denizcilik ve Haberleşme Bakanlığı], 2017). Akıllı telefonların mobilitesi bireylerin temel ihtiyaçlarını karşılamada belirgin faydalar sağlarken, aynı zamanda bazı problemleri de beraberinde getirmektedir (King, Valença, Silva, Baczynski, Carvalho, & Nardi, 2013; King, Valença, Silva, Sancassiani, Machado, & Nardi, 2014; Krajewska-Kulak, Kulak, Stryzhak, Szpakow, Prokopowicz, & Marcinkowski, 2012; Lepp, Barkley, Sanders, Rebold, & Gates, 2013; Pourrazavi, Allahverdipour, Jafarabadi, & Matlabi, 2014).

Nomofobi

Mobil telefon kullanımına bağlı ortaya çıkan problemlerle ilgili yapılan çalışmalarda problemin ismi mobil telefon bağımlılığı (addiction/dependence) olarak tanımlanmıştır (Ehrenberg, Juckes, White, & Walsh, 2008; Hong, Chiu, & Huang, 2012; Toda, Monden, Kubo, & Morimoto, 2006). Son yıllarda yapılan araştırmalarda ise mobil telefon bağımlılığına yakın sayılabilecek nomofobi (nomophobia) kavramı ortaya atılmış ve bu kavramla ilgili birçok çalışma yapılmıştır. Nomofobi 'No mobile Phobia' kelimelerinin kısaltılmış halini alan, cep telefonu ile sağlanan iletişimden yoksun kalma, bağlanamama ve bundan aşırı korkma anlamına gelmektedir (King ve ark., 2013; Yildirim ve Correia, 2015). Kısaca nomofobi cep telefonundan bir şekilde yoksun kalma kokusudur. Teknoloji çağının önemli sendromlarından biri olarak tanımlanan bu durum internet bağlantısı barındıran akıllı telefonların giderek artmasından sonra daha da yaygın hale gelmiştir. Telefonsuz kalma, iletişim kuramama kişide psikolojik gerginlik oluşturmakta ve kişi kendini huzursuz hissetmektedir. Nomofobik özelliğe sahip kişilerde aşağıdaki belirtilerin bir kısmını veya tamamını görmek mümkündür (Bragazzi & Del Puente, 2014; Güzeller & Coşguner, 2012 Haug, Castro, Kwon, Filler, Kowatsch, & Schaub, 2015; Thomée, Härenstam, & Hagberg, 2011).

- Bireyin mobil telefonu yanında değilken kendini boşlukta hissetmesi.
- Mobil telefonu yanındayken takıntılı (obsesif) bir şekilde telefonunu kontrol etmesi.
- Şarjı bitince kendini çaresiz hissetmesi.
- Telefonu bir yerde unutmak, çaldırmak veya arızalanmasından korkması.
- Telefonu yanında değilken baş dönmesi, kalp çarpıntısı, nefes almada zorluk, mide krampları gibi bir takım anksiyete belirtileri yaşanması.

Akıllı telefon bağımlılığı ve buna bağlı olarak nomofobik oluşumlar kişiyi sosyolojik, psikolojik ve fizyolojik açıdan oldukça etkilemektedir. İleri düzeyde problemlerin yaşanmasına sebep olan bu durumlar, radikal önlemlerin alınmasına bile neden olabilmektedir. Örneğin, Almanya'da cep telefonu kullanımına bağlı olarak meydana gelen kazaları engelleme amacıyla trafik ışıklarının kaldırımlara yerleştirildiği ifade edilmektedir (BBC, 2016). Mobil telefon bağımlığı ve nomofobik oluşumlar ciddi boyutlara ulaşmış olacak ki artık hastanelerde bu sorunlara çözüm arayan klinikler açılmaya başlamıştır. Ülkemizde de sağlık bakanlığının bu tür bağımlılık ve psikolojik korkulara yönelik çalışmaları mevcuttur (T.C. Sağlık Bakanlığı, 2018). Son yıllarda öğrenciler üzerinde yapılan araştırmalarda mobil telefonların öğrencilerin akademik başarıları üzerinde olumsuz etkilerinden söz edilmektedir. Yine benzer araştırmalarda mobil telefonla aşırı zaman geçiren öğrencilerin sadece akademik başarılarında düşme söz konusu olmayıp aynı zamanda ailesi ve arkadaşları ile de sosyal ilişkilerinin zayıfladığı da görülmektedir (Yen, Tang, Yen, Lin, Huang, Liu, & Ko, 2009; Jacobsen & Forste, 2011). Dünyada ve ülkemizde yapılan araştırmalar özellikle gençlerin nomofobi düzeylerinin yüksek olduğunu ve yaşamlarını olumsuz yönde etkilediklerini göstermektedir. Bu araştırmaların birçoğunda mobil telefon kullanan erkeklerin kadınlara göre daha fazla nomofobik olduğunu ortaya koymaktadır (Adnan & Gezgin, 2016; Burcuoğlu, 2017; Gezgin, Şahin, & Yıldırım, 2017; Kaur & Sharma, 2015; Tavolacci, Meyrignac, Richard, Dechelotte, Ladner, 2015; Türen, Erdem, & Kalkın, 2017).

Sanal Ortam Yalnızlığı

İnsanoğlu var olduğu günden beri doğası gereği sosyalleşme isteği duyar. Son yüzyıla kadar bu ihtiyacını çevresindeki insanlarla ve gerçek ortamlarda giderebiliyordu. Bilimin ve teknolojinin geliştiği günümüzde bu ihtiyacını artık sosyal ortamda gidermenin yollarını aramış ve nihayetinde sanal ortam denen internet bağlantılı bir sosyal mecraya yönelmiştir (Bingöl & Demir, 2011; Duran & Özkul, 2015; Üstün, Akgün, & Partlak, 2005; Temel & Şişman, 2017). Yalnızlık kavramı istenmeyen bir durum olup üzüntü, endişe, korku gibi olumsuz duygularla berber anılmaktadır. Aynı zamanda yalnızlık kişiye sosyal anlamda ve psikolojik anlamda sıkıntılar doğuran problem olarak görülmektedir (DiTomasso & Spinner, 1997; Peplau & Perlman, 1982). TDK (2018) ise yalnızlığı "yalnız olma durumu, kimsesizlik" olarak açıklamaktadır. Günümüzde sosyal çevrede yaşanılan tüm olayların sanal ortamda da yaşanılabilir olması hayatımızı oldukça etkilemektedir. Sanal ve gerçeklik arasındaki farkın azaldığı günümüzde sanal ortamdaki yaşantı ciddiye alınarak araştırılmalıdır. Özelliklede sanal sosyal medya araçları gençler tarafından daha da önemsenmektedir. Sanal ortamları bu denli cazip kılan şeylerin başında bilgiye kolay erişim, ilgi çekici sosyal ortamların olması, hayatı kolaylaştıracak uygulamaların gün geçtikçe artması olduğu söylenebilir. Kısaca teknolojik bir cihaza sahip olmanın ve bunu kullanabilmenin sunduğu daha birçok avantaj sanal ortamı cazip hale getirmektedir (Amichai-Hamburger & Ben-Artzi, 2003; Korkmaz, Usta, & Kur, 2014). Sanal ortam insanları şekillendirerek toplum yaşamının içinde ikinci bir hayat oluşturmaktadır. Sanal ortam yaşantısı insanların gereksinimlerini baz alarak, ihtiyaçları çerçevesinde kendini göstermektedir. Gerçek ortamdan kendini soyutlamış kişiler için sanal ortam kaçınılmaz bir liman olup kendilerini mutlu hissettikleri bir ortam haline dönüşmektedir (Johnson, 2001; Korkmaz, Usta, & Kur, 2014; Morahan-Martin & Schumacher, 2000; Young, 1998). İnsanlar gerçek sosyal ortamlardaki yalnızlıklarını sanal ortamda gidermeye çalıştıkça yalnızlıklarının derinleştiğinin farkında olmamaktadırlar. Bu nedenledir ki, sanal ortamın yalnızlık giderici etkisi geçek değildir ve geçicidir. Sanal ortamda edinilen dostluklar, ilişkiler yanıltıcıdır ve geçici psikolojik rahatlamanın ötesine geçememektedir. Bireyler sanal yalnızlıklarını gidermekten ziyade gerçek yaşamla barışık ve sağlam temellere dayalı sosyal ilişkilerle sorunlarını çözmelidirler (Özdemir, Akçakanat, & İzgüden, 2017; Ümmet & Ekşi, 2016).

Araştırmanın Amacı ve Önemi

Bu araştırma ile farklı katılımcıların (üniversite öğrencileri, çalışanlar ve ev hanımları) nomofobileri ile sanal ortam yalnızlıkları arasındaki ilişkilerin incelenmesi amaçlanmıştır. Bununla birlikte araştırma kapsamında katılımcıların nomofobileri ile sanal ortam yalnızlıklarının cinsiyetlerine, mesleklerine ve günlük akıllı telefon kullanım sürelerine göre farklılaşıp farklılaşmadığı incelenmiştir. Alan yazın tarandığında nomofobi ile sanal ortam yalnızlığı arasındaki ilişkinin incelenmediği görülmüştür. Bu açıdan çalışma önem kazanmaktadır. Ayrıca elde edilen sonuçlar da bu araştırmanın önemini ortaya koymaktadır.

Yöntem

Araştırma Modeli

İlişkisel tarama ve nedensel karşılaştırma prosedürlerine uygun olarak yürütülen bu araştırmanın verilerinin analizinde betimsel istatistikler, korelasyon analizi, bağımsız örneklem t-testi analizi ve tek yönlü varyans analizi kullanılmıştır. Tarama modelinin bir türü olan ilişkisel tarama modeli, iki ve daha çok sayıdaki değişken arasında değişimin varlığını ve derecesini belirlemeyi amaçlayan araştırma modelidir. İlişkisel tarama modelinin korelasyon ve karşılaştırma türü olmak üzere iki türü vardır. Korelasyon türü araştırma modellerinde, değişkenlerin birlikte değişip değişmediği ve var olan değişimin nasıl olduğu incelenirken, karşılaştırma türünde, en az iki değişken arasında bağımsız değişkene göre gruplar oluşturularak bağımlı değişkene göre gruplar arasında fark olup olmadığı incelenir (Karasar, 2009).

Çalışma Grubu

Araştırmaya Türkiye'nin orta kesimindeki büyük bir ilde yaşayan ve akıllı telefon kullanan toplam 352 kişi gönüllülük esasına göre katılmıştır. Çalışma grubu ile ilgili istatistikî bilgiler Tablo 1'de verilmiştir.

Tablo 1. Çalışma grubunu demografik özellikleri

Değişken	Seçenek	n	f (%)
Cinsiyet	Kadın	178	50.6
	Erkek	174	49.4
Meslek	Çalışan	138	39.2
	Ev hanımı	57	44.6
	Öğrenci	157	16.2
Günlük Akıllı Telefon Kullanım Süresi	1-3 saat arası	171	48.6
	3-5 saat arası	93	26.4
	5 saat ve üzeri	88	25

Tablo 1'de görüldüğü üzere çalışmaya katılanların 178'i kadınlardan oluşurken 174'ü erkeklerden oluşmaktadır. Katılımcıların meslek türlerine bakıldığında, 138'i çalışan, 57'si ev hanımı, 157'si öğrencidir. Ayrıca katılımcıların günlük mobil telefon kullanım sürelerine bakıldığında 1-3 saat arası kullanan 171, 3-5 saat kullanan 93 ve 5 saat ve üzeri kullanan 88 kişi olduğu görülmektedir.

Veri Toplama Araçları

Araştırmada gerekli olan veriler farklı iki ölçme aracı ile toplanmıştır.

Nomofobi Ölçeği

Katılımcıların nomofobi durumlarını ölçmek için Yıldırım ve Correia (2015) tarafından geliştirilen ve yine Yildirim, Sumuer, Adnan, & Yildirim (2016) tarafından Türkçe'ye uyarlanan "Nomofobi Ölçeği" kullanılmıştır. Bu ölçek 20 maddeden ve dört alt boyuttan (1: İletişim kuramama, 2: Bağlantıyı kaybetme, 3: Bilgiye erişememe, 4: Cihazdan yoksunluk) oluşmaktadır. Tüm maddelerin ortalama Cronbach's alpha değeri 0.92; sırası ile 4 alt boyutun Cronbach's alpha değerleri 0.90, 0.74, 0.94, 0.91'dir. Ölçeğin geçerliği ve güvenilirliği tatmin edici seviyededir. Ölçekte veriler 5'li Likert tipinde hazırlanmıştır (1.Kesinlikle Katılmıyorum, 5.Kesinlikle Katılıyorum).

Sanal Ortam Yalnızlık Ölçeği (SOYÖ)

Katılımcıların sanal ortam yalnızlıklarını ölçmek için Korkmaz, Usta ve Kurt (2014)'un geliştirdiği "Sanal Yalnızlık Ölçeği" kullanılmıştır. Bu ölçek 20 maddeden ve 3 alt boyuttan (1:Sanal Sosyalleşme, 2:Sanal Paylaşım, 3: Sanal Yalnızlık) oluşmaktadır. Ölçekte toplam puana ilişkin korelasyon değeri 0.948 iken alt boyutlarda ki korelasyon değerleri F1: 0.941, F2: 0.940, F3: 0.889 dir. Ayrıca Cronbach's Alpha değerleri toplamda 0.816; alt boyutlarda F1: 0.842, F2: 0.809, F3: 0.614'dır. Ölçeğin geçerliği ve güvenilirliği tatmin edici seviyededir. Ölçekte veriler 5'li Likert tipinde hazırlanmıştır (1.Hiç yansıtmıyor, 5.Tamamen yansıtıyor).

Bulgular

Katılımcıların Nomofobi ve Sanal Ortam Yalnızlık Düzeyleri

Katılımcıların nomofobi ve sanal ortam yalnızlıklarına ait hesaplanan ortalama puan sonuçları Tablo 2'de gösterilmiştir.

Tablo 2. Katılımcıların nomofobi ve sanal ortam yalnızlık düzeyleri

Ölçek	Alt Boyut	N	Min.	Mak.	X̄	SS
Nomofobi	Bilgiye Erişememe	352	1	5	**3.08**	1.164
	Bağlantı Kaybetme	352	1	5	**2.70**	1.117
	İletişim Kuramama	352	1	5	**3.01**	1.160
	Cihazdan Yoksunluk	352	1	5	2.22	1.120
Sanal Ortam Yalnızlığı	Sanal Sosyalleşme	352	1	5	**2.62**	0.805
	Sanal Paylaşım	352	1	5	1.79	0.920
	Sanal Yalnızlık	352	1	5	**3.28**	0.895

Tablo 2'de görüldüğü üzere katılımcıların nomofobi düzeylerinin bilgiye erişememe ($\bar{X}$=3.08), bağlantıyı kaybetme ($\bar{X}$=2.70) ve iletişim kuramama ($\bar{X}$=3.01) alt boyutlarında ortalamanın üstünde cihazdan yoksunluk ($\bar{X}$=2.22) alt boyutunda ise ortalamanın altında oldukları gözlemlenmiştir. Yine aynı tabloda katılımcıların sanal ortam yalnızlıklarının ise, sanal sosyalleşme ($\bar{X}$=2.62) ve sanal yalnızlık ($\bar{X}$=3.28) alt boyutlarında ortalamanın üzerinde, sanal paylaşım ($\bar{X}$=1.79) alt boyutunda ise ortalamanın altında oldukları tespit edilmiştir.

Nomofobi ve Sanal Ortam Yalnızlığı Arasındaki İlişkiler

Katılımcıların nomofobi ve sanal ortam yalnızlıkları arasındaki ilişki sonuçları Tablo 3'te gösterilmiştir.

Tablo 3. Nomofobi ve sanal ortam yalnızlığı arasındaki ilişkiler

Değişken		1	2	3	4	5	6	7
Nomofobi	1. Bilgiye Erişememe	–						
	2. Bağlantı Kaybetme	**.643****	**–**					
	3. İletişim Kuramama	**.540****	**.709****	**–**				
	4. Cihazdan Yoksunluk	**.488****	**.763****	**.564****	**–**			
Sanal Ortam Yalnızlığı	5. Sanal Sosyalleşme	**.194****	**.380****	**.320****	**.533****	**–**		
	6. Sanal Paylaşım	**.218****	**.429****	**.330****	**.583****	**.560****	**–**	
	7. Sanal Yalnızlık	**-.130***	**-.115****	**-.178***	-.102	**.107***	**-.113***	–

**: Correlation is significant at the 0.01 level (2-tailed).
*: Correlation is significant at the 0.05 level (2-tailed).

Tablo 3'te görüldüğü üzere katılımcıların nomofobileri ile sanal ortam yalnızlıklarının cihazdan yoksunluk ile sanal yalnızlık alt boyutları hariç diğer tüm alt boyutlar arasındaki ilişkilerin pozitif yönde ve anlamlı düzeyde olduğu tespit edilmiştir.

Nomofobi ve Sanal Ortam Yalnızlığının Cinsiyete Göre İncelenmesi

Katılımcıların nomofobi ve sanal ortam yalnızlıklarının arasındaki cinsiyet açısından incelenmesi sonuçları Tablo 4'de gösterilmiştir.

Tablo 4. Nomofobi ve sanal ortam yalnızlığının cinsiyet açısından analiz sonuçları

Ölçek	Alt boyut	Cinsiyet	N	X̄	SS	t	p
Nomofobi	Bilgiye Erişememe	Kadın	178	3.21	1.053	2.155	**.032**
		Erkek	174	2.95	1.257		
	Bağlantı Kaybetme	Kadın	178	2.95	1.164	4.394	**.000**
		Erkek	174	2.44	1.007		
	İletişim Kuramama	Kadın	178	3.36	1.081	5.997	**.000**
		Erkek	174	2.66	1.131		
	Cihazdan Yoksunluk	Kadın	178	2.28	1.089	1.101	.272
		Erkek	174	2.15	1.150		
Sanal Ortam Yalnızlığı	Sanal Sosyalleşme	Kadın	178	2.64	0.845	0.480	.631
		Erkek	174	2.60	0.764		
	Sanal Paylaşım	Kadın	178	1.82	1.010	0.721	.471
		Erkek	174	1.75	0.819		
	Sanal Yalnızlık	Kadın	178	3.29	0.971	0.375	.708
		Erkek	174	3.26	0.812		

Tablo 4'te elde edilen bulgulara bakıldığında cihazdan yoksunluk alt boyutu hariç genel olarak kadın katılımcıların erkek katılımcılara göre daha nomofobik olduğu görülürken ($p<0.05$), sanal ortam yalnızlığında ise cinsiyet açısından erkekler ile kadınlar arasında anlamlı bir fark bulunamamıştır.

Nomofobi ve Sanal Ortam Yalnızlığının Mesleğe Göre İncelenmesi

Katılımcıların nomofobi ve sanal ortam yalnızlıklarının mesleklerine göre incelenmesi sonuçları Tablo 5'de gösterilmiştir.

Tablo 5. *Nomofobi ve Sanal Ortam Yalnızlığının Meslek Açısından Analiz Sonuçları*

Ölçek		Meslek	N	$\bar{X}$	SD	F	p	Fark (Scheffe)
Nomofobi	Bilgiye Erişememe	Çalışan	138	2.886	1.3170	8.817	**.000**	Öğrenci>Çalışan Öğrenci>Ev hanımı
		Ev hanımı	57	2.785	0.8932			
		Öğrenci	157	3.365	1.0452			
	Bağlantı Kaybetme	Çalışan	138	2.494	1.1662	3.705	**.026**	Öğrenci>Çalışan
		Ev hanımı	57	2.811	1.3807			
		Öğrenci	157	2.828	0.9325			
	İletişim Kuramama	Çalışan	138	2.781	1.2214	5.032	**.007**	Öğrenci>Çalışan
		Ev hanımı	57	3.044	1.3287			
		Öğrenci	157	3.205	0.9994			
	Cihazdan Yoksunluk	Çalışan	138	2.077	1.1752	2.022	.134	
		Ev hanımı	57	2.214	1.1320			
		Öğrenci	157	2.339	1.0572			
Sanal Ortam Yalnızlığı	Sanal Sosyalleşme	Çalışan	138	2.662	0.8528	2.147	**.036**	Öğrenci>Ev hanımı
		Ev hanımı	57	2.371	0.7246			
		Öğrenci	157	2.677	0.7774			
	Sanal Paylaşım	Çalışan	138	1.658	0.8996	5.605	**.004**	Öğrenci>Çalışan Öğrenci>Ev hanımı
		Ev hanımı	57	1.607	1.0820			
		Öğrenci	157	1.967	0.8715			
	Sanal Yalnızlık	Çalışan	138	3.341	0.8684	1.152	.317	
		Ev hanımı	57	3.340	1.1606			
		Öğrenci	157	3.195	0.8029			

Tablo 5'te elde edilen bulgulara göre genel olarak öğrencilerin, çalışanlara ve ev hanımlarına göre hem daha nomofobik hem de sanal ortamda kendilerini daha fazla yalnız hissettikleri ortaya çıkmıştır ($p<0.05$).

Nomofobi ve Sanal Ortam Yalnızlığının Günlük Akıllı Telefon Kullanım Süresine Göre İncelenmesi

Katılımcıların nomofobi ve sanal ortam yalnızlıklarının akıllı telefon kullanım süreleri açısından incelenmesi sonuçları Tablo 6'da gösterilmiştir.

Tablo 6. Nomofobi ve Sanal Ortam Yalnızlığının Günlük Akıllı Telefon Kullanım Süresi Açısından Analiz Sonuçları

Ölçek		GATKS[1]	N	$\overline{X}$	SS	F	p	Fark (Scheffe)
Nomofobi	Bilgiye Erişememe	1-3 saat arası	171	2.616	1.0604	32.948	**.000**	3-5 saat>1-3 saat 5 saat ve üzeri>1-3 saat
		3-5 saat arası	93	3.403	1.0947			
		5 saat ve üzeri	88	3.353	1.0650			
	Bağlantı Kaybetme	1-3 saat arası	171	2.214	1.0232	38.069	**.000**	3-5 saat>1-3 saat 5 saat ve üzeri>1-3 saat
		3-5 saat arası	93	3.054	0.9574			
		5 saat ve üzeri	88	3.248	1.0566			
	İletişim Kuramama	1-3 saat arası	171	2.541	1.1714	32.876	**.000**	3-5 saat>1-3 saat 5 saat ve üzeri>1-3 saat
		3-5 saat arası	93	3.392	0.9484			
		5 saat ve üzeri	88	3.528	0.9673			
	Cihazdan Yoksunluk	1-3 saat arası	171	1.870	0.9566	26.157	**.000**	3-5 saat>1-3 saat 5 saat ve üzeri>1-3 saat 5 saat ve üzeri>3-5 saat
		3-5 saat arası	93	2.239	0.9914			
		5 saat ve üzeri	88	2.864	1.2549			
Sanal Ortam Yalnızlığı	Sanal Sosyalleşme	1-3 saat arası	171	2.450	0.7273	15.611	**.000**	5 saat ve üzeri>1-3 saat 5 saat ve üzeri>3-5 saat
		3-5 saat arası	93	2.569	0.7777			
		5 saat ve üzeri	88	3.011	0.8534			
	Sanal Paylaşım	1-3 saat arası	171	1.495	0.6895	22.247	**.000**	3-5 saat>1-3 saat 5 saat ve üzeri>1-3 saat 5 saat ve üzeri>3-5 saat
		3-5 saat arası	93	1.903	0.8413			
		5 saat ve üzeri	88	2.235	1.1616			
	Sanal Yalnızlık	1-3 saat arası	171	3.365	0.9705	2.317	.100	
		3-5 saat arası	93	3.265	0.7628			
		5 saat ve üzeri	88	3.114	0.8565			

GATKS[1]: Günlük Akıllı Telefon Kullanım Süresi

Tablo 6'da elde edilen bulgulara göre genel olarak akıllı telefon kullanım süresi arttıkça katılımcıların hem daha fazla nomofobik olduğu hem de sanal ortamda kendilerini daha fazla yalnız hissettikleri söylenebilir.

Tartışma ve Sonuç

Bu araştırma ile farklı katılımcıların (üniversite öğrencileri, çalışanlar ve ev hanımları) nomofobileri ile sanal ortam yalnızlıkları arasındaki ilişkiler incelenmiştir. Örneklemdeki katılımcıların farklı kesimlerden seçilmesindeki sebep nomofobik durumların ve sanal ortam yalnızlıklarının günümüzde sadece öğrenci veya genç bireylerde ortaya çıkmıyor olmasıdır. Elde edilen veriler her ne kadar genel olarak öğrencilerin, çalışan ve ev hanımlarına göre hem daha nomofobik hem de sanal ortamda kendilerini daha fazla yalnız hissettikleri ortaya çıkarsa da diğer katılımcı türlerinde de anlamlı düzeyde nomofobik ve sanal ortam yalnızlığı düzeyleri yüksek görülmektedir. Yapılan benzer bir çalışmada kamu sektörü (TCDD) çalışanları ile İnönü Üniversitesi lisans öğrencileri arasındaki nomofobi yaygınlığı ölçülmüş, her iki grubunda nomofobik olduğu fakat öğrenci grubunun kamu çalışanlarına göre daha yüksek oranda nomofobik olduğu görülmüştür (Türen, Erdem, & Kalkın, 2017). Elde edilen bu sonuç bizim çalışmamızı destekler niteliktedir.

Araştırmanın bir diğer bulgularına göre, katılımcıların nomofobilerinin bilgiye erişememe, iletişim kuramama ve bağlantı kaybetme alt boyutlarında ortalamanın üzerinde oldukları, cihazdan yoksunluk alt boyutunda ise ortalamanın altında oldukları belirlenmiştir. Cihazdan yoksunluk alt boyutunun ortalamanın altında olmasının bu alt boyuttaki sorulara baktığımızda normal karşılanabilir. Örneğin; gelen aramalar ve mesajları alamama (kapsama alanlarının genişlemesi etkilemiş olabilir), kontör veya kota bitimi (sınırsız veya uzun dakikalık paket kampanyaların olması), şarjın bitmesi (birçok yerde şarj istasyonu olması ve power bankların yaygınlaşması) vb. sorunlara ait yeni çözümler cihazdan yoksunluğu negatif yönde etkilemiş olabilir (Adnan & Gezgin, 2016; Türen, Erdem, & Kalkın, 2017).

Katılımcıların sanal ortam yalnızlıklarının ise, sanal sosyalleşme ve sanal yalnızlık alt boyutlarında ortalamanın üzerinde, sanal paylaşım alt boyutunda ise ortalamanın altında oldukları tespit edilmiştir. Alan yazın incelendiğinde genel olarak, sanal yalnızlık ölçeğinde sanal ortam yalnızlığı alt boyutunun ortalamanın üzerinde bulunduğu görülürken Ümmet ve Ekşi (2016)'nin genç yetişkinler üzerinde yaptığı çalışmada ise sanal yalnızlık boyutu ortalamanın altında sonuç vermiştir. Bu farklılıkların seçilen hedef kitlenin birbiriyle aynı olmamasından kaynaklandığı düşünülmektedir.

Katılımcıların nomofobileri ile sanal ortam yalnızlıklarının cihazdan yoksunluk ve sanal yalnızlık boyutları hariç pozitif yönde ve anlamlı düzeyde ilişkili olduğu tespit edilmiştir. Alan yazında nomofobileri ile sanal ortam yalnızlıklarının ilişkisel incelemesini yapan çalışmaya rastlanılmamıştır.

Çalışmanın diğer bir bulgusuna göre genel olarak kadın katılımcıların erkek katılımcılara göre daha nomofobik olduğu görülürken, benzer çalışmalarda da sonuçlar bu çalışmayla örtüşmektedir (Adnan & Gezgin, 2016; Ehrenberg ve ark., 2008; Hong, Chiu, & Huang, 2012; Özdemir, Akçakanat, & İzgüden, 2017; Türen, Erdem, & Kalkın, 2017). Sanal ortam yalnızlığında ise cinsiyet açısından erkekler ile kadınlar arasında anlamlı bir fark bulunamamıştır.

Son olarak, günlük akıllı telefon kullanım süresi arttıkça katılımcıların hem daha fazla nomofobik olduğu hem de sanal ortamda kendilerini daha fazla yalnız hissettikleri belirlenmiştir. İnternet bağlantısına sahip telefon kullanımının yaygın olduğu günümüzde nomofobik durumların ve sanal ortam yalnızlığının daha da artacağı elde edilen veriler doğrultusunda görülmektedir. Mobil telefon kullanımında sadece konuşma ve mesajla görüşme ile sınırlı kalınmadığı gerçeği ortaya çıkmaktadır.

Kaynakça

Adnan, M., & Gezgin, D. M. (2016). A Modern Phobia: Prevalence of Nomophobia among College Students. *Ankara University Journal of Faculty of Educational Sciences*, *49*(1), 141-158.

Amichai-Hamburger, Y., & Ben-Artzi, E. (2003). Loneliness and Internet use. *Computers in Human Behavior*, *19*(1), 71-80.

BBC. (2016). Akıllı Telefon Kullanıcılarına Yerde Trafik Lambası. http://www.bbc.com/turkce/haberler/2016/04/160428_akilli_telefon_yerde_trafik_isigi. (Erişim: Tarihi: 01 Mart 2018).

Bingöl. G.. & Demir. A. (2011). Amasya sağlık yüksekokulu öğrencilerinin iletişim becerileri. *Göztepe Tıp Dergisi*, *26*(4), 152-159.

Bragazzi, N. L., & Del Puente, G. (2014). A proposal for including nomophobia in the new DSM-V. *Psychology Research and Behavior Management*, *7*, 155-160.

Burucuoğlu, M. (2017). Meslek Yüksekokulu Öğrencilerinin Nomofobi Düzeyleri Üzerinde Bir Araştırma. *Karabük Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *7*(2), 482-489.

DiTommaso, E., & Spinner, B. (1997). Social and emotional loneliness: A re-examination of Weiss' typology of loneliness. *Personality and Individual Differences*, *22*(3), 417-427.

Ehrenberg, A., Juckes, S., White, K. M., & Walsh, S. P. (2008). Personality and self-esteem as predictors of young people's technology use. *Cyberpsychology & Behavior*, *11*(6), 739-741.

Gezgin, D. M., Şahin, Y. L., & Yıldırım, S. (2017). Sosyal ağ kullanıcıları arasında nomofobi yaygınlığının çeşitli faktörler açısından incelenmesi. *Eğitim Teknolojisi Kuram ve Uygulama*, *7*(1), 1-15.

GSMA Intelligence. Global Data. (2018) *Available at: https://gsmaintelligence.com/* (Erişim Tarihi: 1 Mart 2018).

Güzeller, C. O., & Coşguner, T. (2012). Development of a problematic mobile phone use scale for Turkish adolescents. *Cyberpsychology, Behavior, and Social Networking*, *15*(4), 205-211.

Haug, S., Castro, R. P., Kwon, M., Filler, A., Kowatsch, T., & Schaub, M. P. (2015). Smartphone use and smartphone addiction among young people in Switzerland. *Journal of Behavioral Addictions*, *4*(4). 299-307.

Hong, F. Y., Chiu, S. I., & Huang, D. H. (2012). A model of the relationship between psychological characteristics, mobile phone addiction and use of mobile phones by Taiwanese university female students. *Computers in Human Behavior*, *28*(6), 2152-2159.

Jacobsen, W. C., & Forste, R. (2011). The wired generation: Academic and social outcomes of electronic media use among university students. *Cyberpsychology, Behavior, and Social Networking*, *14*(5), 275-280.

Johnson, C. M. (2001). A survey of current research on online communities of practice. *The Internet and Higher Education*, *4*(1), 45-60.

Karasar, N. (2009). *Bilimsel araştırma yöntemi* (19. baskı). Ankara: Nobel Yayın Dağıtım.

Kaur, A., & Sharma, P. (2015). A descriptive study to assess the risk of developing nomophobia among students of selected nursing colleges Ludhiana, Punjab. *International Journal of Psychiatric Nursing*, *1*(2), 1-6.

King, A. L. S., Valença, A. M., Silva, A. C. O., Baczynski, T., Carvalho, M. R., & Nardi, A. E. (2013). Nomophobia: Dependency on virtual environments or social phobia?. *Computers in Human Behavior*, *29*(1), 140-144.

King, A. L. S., Valença, A. M., Silva, A. C., Sancassiani, F., Machado, S., & Nardi, A. E. (2014). "Nomophobia": impact of cell phone use interfering with symptoms and emotions of individuals with panic disorder compared with a control group. *Clinical Practice and Epidemiology in Mental Health: CP & EMH*, *10*, 28.

Korkmaz, Ö., Usta, E., & Kurt. İ. (2014). Sanal ortam yalnızlık ölçeği (SOYÖ) geçerlik ve güvenirlik çalışması. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi (H. U. Journal of Education)*, *29*(2), 144-159.

Krajewska-Kulak, E., Kulak, W., Stryzhak, A., Szpakow, A., Prokopowicz, W., & Marcinkowski, J. T. (2012). Problematic mobile phone using among the Polish and Belarusian University students, a comparative study. *Progress in Health Sciences*, *2*(1), 45-51.

Lepp, A., Barkley, J. E., Sanders, G. J., Rebold, M., & Gates, P. (2013). The relationship between cell phone use, physical and sedentary activity, and cardiorespiratory fitness in a sample of US college students. *International Journal of Behavioral Nutrition and Physical Activity*, *10*(1), 79.

Morahan-Martin, J., & Schumacher, P. (2000). Incidence and correlates of pathological Internet use among college students. *Computers in Human Behavior*, *16*, 2-13.

Okur, H. D., & Özkul, M. (2015). Modern iletişimin arayüzü: Sanal iletişim sosyal paylaşım sitelerinin toplumsal ilişki kurma biçimlerine etkisi (Facebook örneği). *Süleyman Demirel Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *21*, 213-246.

Özdemir, S., Akçakanat, T., & İzgüden, D. (2017). İnternet çağında sanal ortam yalnızlığı: üniversite öğrencileri üzerine bir araştırma. *Süleyman Demirel Üniversitesi Vizyoner Dergisi*, *8*(19), 125-136.

Peplau, L. A., & Perlman, D. (1982). *Loneliness: A sourcebook of current theory, research, and therapy*. NY, New York: John Wiley and Sons.

Pourrazavi, S., Allahverdipour, H., Jafarabadi, M. A., & Matlabi, H. (2014). A socio-cognitive inquiry of excessive mobile phone use. *Asian Journal of Psychiatry*, *10*, 84-89.

T.C. Sağlık Bakanlığı (2018). Kocaeli Sağlık Müdürlüğü. http://kocaelism.saglik.gov.tr/TR.60456/teknoloji-bagimliligi-ile-mucadele-egitimi-duzenlendi.html (Erişim Tarihi: 15.03.2018).

Tavolacci, M. P., Meyrignac, G., Richard, L., Dechelotte, P., & Ladner, J. (2015). Problematic use of mobile phone and nomophobia among French college students. *European Journal of Public Health*, *25*(3).

TDK. (2018). http://www.tdk.gov.tr. Erişim Tarihi: 1 Mart 2018.

Temel. M.. & Şişman. F. N. (2017). İletişim becerileri eğitiminin hemşirelik öğrencilerinin sanal ve kişilerarası ilişkilerine etkisi. *Sağlık Bilimleri ve Meslekleri Dergisi*, *4*(3). 171-179.

Thomée, S., Härenstam, A., & Hagberg, M. (2011). Mobile phone use and stress, sleep disturbances, and symptoms of depression among young adults-a prospective cohort study. *BMC Public Health*, *11*(1), 66.

Toda, M., Monden, K., Kubo, K., & Morimoto, K. (2006). Mobile phone dependence and health-related lifestyle of university students. *Social Behavior and Personality: An International Journal*, *34*(10), 1277-1284.

Türen, U., Erdem, H., & Kalkın, G. (2017). Mobil telefon yoksunluğu korkusu (nomofobi) yayılımı: Türkiye'den üniversite öğrencileri ve kamu çalışanları örneklemi. *Bilişim Teknolojileri Dergisi*, *10*(1), 1-12.

UDHB. (2017). Ulaştırma Denizcilik ve Haberleşme Bakanlığı. Haberleşme İstatistiki Verileri. http://www.udhb.gov.tr/images/istatistik/2003-2017.pdf. (Erişim Tarihi: 1 Mart 2018).

Ümmet, D., & Ekşi, F. (2016). Türkiye'deki genç yetişkinlerde internet bağımlılığı: yalnızlık ve sanal ortam yalnızlık bağlamında bir inceleme. *Addicta: The Turkish Journal on Addictions*, *3*(1), 29-53.

Üstün, B., Akgün, E., & Partlak, N. (2005). *Hemşirelikte iletişim becerileri öğretimi*. Ankara: Okullar Yayınevi.

Yen, C. F., Tang, T. C., Yen, J. Y., Lin, H. C., Huang, C. F., Liu, S. C., & Ko, C. H. (2009). Symptoms of problematic cellular phone use, functional impairment and its association with depression among adolescents in Southern Taiwan. *Journal of Adolescence*, *32*(4), 863-873.

Yildirim, C., & Correia, A. P. (2015). Exploring the dimensions of nomophobia: Development and validation of a self-reported questionnaire. *Computers in Human Behavior*, *49*, 130-137.

Yildirim, C., Sumuer, E., Adnan, M., & Yildirim, S. (2016). A growing fear: Prevalence of nomophobia among Turkish college students. *Information Development*, *32*(5), 1322-1331.

Young, K. S. (1998). *Caught in the net: How to recognize the signs of internet addiction-and a winning strategy for recovery*. New York, NY: John Wiley & Sons.

Illustrative Digital Textures on Movie Posters in The Context of Art and Technology

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Abstract: Illustrations are the most important factors that generate visual solutions in advertising and promotional applications. They provide re-perception by adding different meanings and dimensions to the content they are connected to. It is the most effective method of ensuring that expressions, concepts, actions are communicated easily. Illustrations are among the contemporary visual arts with their own style of the creator, like a signature, with different and extraordinary production techniques. With the developing technology and digital possibilities, the art of illustration can be produced by traditional methods as well as in the digital environment. One of the areas where illustration is often used is media fields such as cinema and television. Today, traditional tastes from the past are preparing illustrative content posters for many films.Purpose of the research; to examine and evaluate the approaches of digital illustration artists to textures which is one of the basic elements of visual expression language of art in cinema posters that one of the leading visual media faces of our time is cinema banners.

Keywords: Cinema, Movie Poster, Digital Illustration.

Sanat Ve Teknoloji Bağlaminda Sinema Afişlerinde İllüstratif Dijital Doku

Özet: İllüstrasyonlar, reklam ve tanıtım uygulamalarında görsel çözümler üreten etmenlerden en önemlisidir. Bağlı oldukları içeriğe, farklı anlam ve boyutlar ekleyerek yeniden algılanmasını sağlar. İfadelerin, kavramların, eylemlerin iletilmesinde, kolayca kavranmasını sağlayabilen en etkili yöntemdir. İllüstrasyon günümüz görsel sanatları arasında, farklı ve sıradışı üretim teknikleriyle adeta bir imza gibi yaratıcısının kendisine has üslubunu içerisinde barındırmaktadır. Gelişen teknoloji ve dijital imkanlarla birlikte illüstrasyon sanatı da halen geleneksel yöntemlerle üretilebildiği gibi sayısal ortamda da üretilebilmektedir. Sıklıkla kullanıldığı alanlardan biriside sinema, televizyon gibi medya alanlarıdır. Günümüzde geçmişten gelen geleneksel tatla bir çok film için illüstratif içerikli afişler hazırlanmaktadır.Araştırmanın amacı çağımızın önde gelen görsel medya yüzlerinden biri olan sinema afişlerinde, dijital illüstrasyon sanatçılarının sanatın görsel anlatım dilinin temel unsurlarından biri olan dokuya olan yaklaşımlarını belirlenen örneklem çalışmalar üzerinden incelemek ve değerlendirmektir.

Anahtar Kelimeler: Sinema, Afiş, Dijital İllüstrasyon.

Giriş

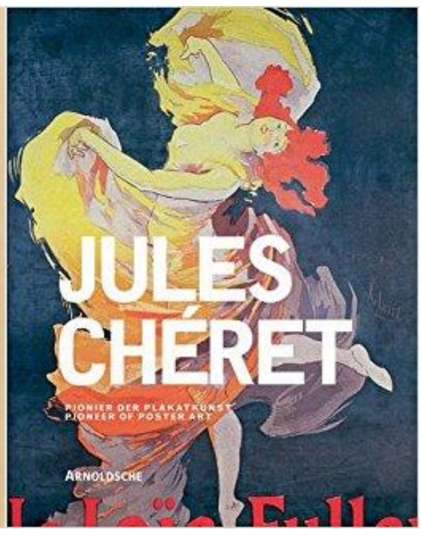
Her tasarım, özüne inildiğinde bir gereksinim sonucu ortaya çıktığı ortaya çıkmaktadır Teknolojik bir buluş ve dönüm noktası olan sinema, ortaya çıkışından günümüze resim sanatıyla oldukça yakın bir etkileşim içindedir (Karakaya, 2005, s.135).

Sözlük anlamı "izah edici resim" demek olan illüstrasyon, belirli fikir ya da olayların, gerekli durumlarda yorumlama yapılmaksızın direkt uygulanması veya farklı yorumların eklenerek şekillendirilmesi aracılığıyla üretilen resimleme biçimidir (Tepecik, 2002 s.79). Reklam ve tanıtım unsurlarının vazgeçilmez görsel çözümlerinden olan illüstrasyon sanatının, bir çok sanatsal alanda olduğu gibi sinema dalında da oldukça etkin bir rolü vardır (Çam, 2012, s.13) Önceleri üretim ve çoğaltım aşamaları oldukça sınırlı ve de çözüm üretemeyecek kadar pahalı olan fotoğrafçılığın yerine sinema afişlerinde kullanılan resimleme yöntemi, günümüzde sinema yapımlarına daha sanatsal bir kimlik kazandırmak amacıyla tanıtımlarda yer almaktadır. Eskiden filmin oyuncularını tanıtmak ve filmin climax'ları hakkında izleyiciye ipucu vererek onları filmi izlemeye teşvik etmek amacıyla filmden çarpıcı sahneleri ve de oyunculardan dramatik pozları bir arada izleyiciye sunan illüstratif afişler, sanatçıların atölyelerinde ünlü oyuncuları referans alarak resmetmeleri ve gerekirse modellerden yardım almalarıyla oluşmaktaydı.

Fotoğrafçılığın ve fotoğrafik çoğaltma tekniklerinin daha ulaşılabilir olmasıyla film afişlerinde illüstratif üretimler yerini git gide fotoğrafik öğelerin kullanımına bırakmıştır. Yine de, Karadağ'ın da dediği gibi, fotoğraf sanatı dışındaki diğer sanat dalları, ilk olarak hayal gücüyle iletişime geçer. Fotoğraf sanatı ise önce görmek, ardından ayrıştırıcı gözlemlerde bulunmak ve de imgesel yönde tasarlamak olgularına dayanır (Karadağ, 2004, s.46).

Afiş Sanatının Gelişimi

Afişlerin ilk örneklerin çoğaltımı taş baskı (litografi) tekniğiyle sağlanabilmiştir. Taş baskıyla çoğaltılan ilk afiş çalışmalarının öncüleri olan Bonnar ve Lautrec gibi ressamlar, afiş sanatını farklı baskı teknikleriyle çoğaltılabilen ve basit birer reklam aracı olmaktan çıkarıp onları birer sanat eseri haline getirerek ayrı bir sanat dalı oluşturmuşlardır (Yaman ve diğerleri, 2014, s.56). Jules Chéret, 1800'lerin ortalarında Paris'te açtığı litografi ve matbaa atölyesinde ürettiği büyük ebatlı renkli litografi afişleri sayesinde "illüstrafik afişlerin babası" ünvanını kazanmıştır (Öztuna, 2007, s.8).



Tüm bunların yanı sıra afiş sanatını diğer sanat dallarından ayıran farklı bir dili ve de zorlukları vardır. Özünde tanıtım ya da iletilmek istenen bir mesaj kaygısı olmasının yanında görsel tasarım unsurlarını da etkili ve dengeli bir şekilde bulundurması gerektirmektedir. Etkili bir afiş tasarımı bünyesinde, dikkat çekicilik, izleyiciyi bilgilendirici ve onda istek uyandırıcı özellikler barındırır, hedeflenen belirli bir kesime etkili bir biçimde ulaşabilir ve kolayca anlaşılabilen bütünsel bir dile sahiptir (Becer, 1997, s.201) Afiş tasarımına başlamadan önce tasarıma yön verecek en önemli olgu, onun fotoğrafik görsellerle mi, illüstratif görseller kullanılarak mı yoksa sadece tipografik düzenlemelerle mi oluşturulacağına gerekli araştırmaları yapıp en etkili yöntemi belirleyerek karar vermektir (Ertan ve Sansarci, 2017, s.3).

Afişler, ticari, kültürel ve sosyal afişler olarak üç ayrı kategoriye ayrıldığında sinema afişleri kültürel afişler arasında yerini alır. Festivaller, seminerler, sempozyumlar, balolar, konserler, sinema filmleri, tiyatro oyunları, sergiler ve spor etkinlikleri gibi kültürel faaliyetleri tanıtan afişler de kültürel afişler kategorisine girmektedirler (İncearik, 2011, s.33).

Afiş tasarım teknikleri, teknik donanımların gelişmesiyle doğru orantılı olarak ilerleme kaydetmiştir. Baskı ve çoğaltım teknolojileri, zamanın ilerleyen teknolojik yeniliklerine paralel bir şekilde gelişmiştir. Fotoğraf sanatının ve optik teknolojinin kamusal hayata dahil edilmesi ilk dönemlerde afiş tasarımına baskın bir şekilde yön verirken, illüstratif uygulamalara tekrar dönülmesi sanatsal üretimlere verilen önemi ortaya sermektedir (Doğan, 2009, s.243).

İllüstrasyon Sanatının Gelişimi

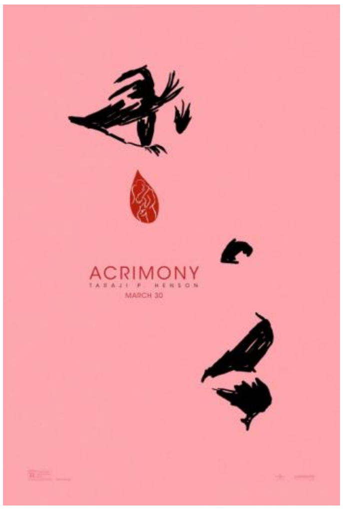
Plastik sanatların özellikle üretim aşamalarına etki eden teknolojik gelişmeler ve kolaylıklar elbette ki illüstrasyon sanatını da etkilemiş, üretim yelpazesini daha da genişletmiştir. Fotografi tekniğinin 19. yüzyılda keşfedilmesi, ofset ve klişe rekniklerindeki yenilikler baskı araçlarındaki çoğaltma olanaklarının kolaylaşması ve sınırsız yeniden üretim olanakları, sanatçının daha da özgürleşmesine, illüstrasyonda sonsuz teknik ve boyama olanaklarına erişmesine sebep oldu (Kaptan, 1996 s58). Modern bir endüstriyel toplumun vazgeçemediği en önemli araçlardan biri olan bilgisayarların sınırsız konuda sunduğu gibi illüstrasyon üretiminde de sunduğu kullanım imkanları hayal edilemeyecek boyuttadır (Çam, 2012 s14).

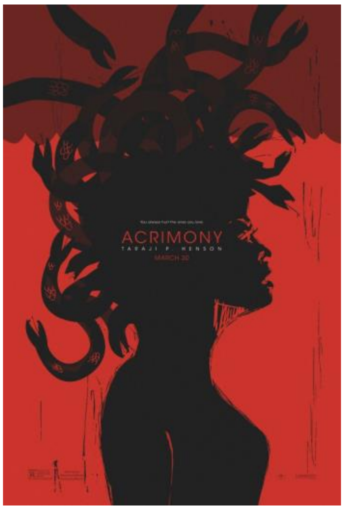
Günümüzde halen geleneksel yöntemlerle üretilebilen illüstrasyon sanatı, yapısı ve çok yönlülüğü sayesinde fotoğraf, tipografi, kolaj sanatı ve farklı bilgisayar yazılımlarından faydalanabilmektedir. Çakmak, S. (2010). Bir illüstrasyon sanatçısı, temsil ettiği konuyu daha ilgi çekici, çarpıcı hale getirebilmek için renk, biçim, doku gibi öğelerde düzenlemelerde bulunabilir (Pektaş, 1988 s.46) Afişlerde kullanılan renk, doku, biçim, şekil gibi öğeler, izleyiciler üzerinde psikolojik etkiler ve farklı uyarımlara neden olur (Doğan, 2009, s.79). Dolayısıyla bir illüstrasyon sanatçısı amaçladığı duyguları izleyicide uyandırabilmesi için bu sanatsal öğelerle rahatça oynaması ve en etkin biçimde kullanması oldukça önemlidir. İşte bilgisayarın ve bilgisayar programlarının illüstrasyon üretimindeki kullanımı, sanatçıya bu düzenlemeleri yapabilmesi için daha rahat ve sınırsız bir ortam sunmaktadır.

Diğer sanatsal elemanlar içlerinde doku olgusu, insanın hem görme hem de dokunma duyusuna hitap etmektedir. Doku, yüzeyinde bulunduğu nesnenin hem içyapısı hem de dış yapısı hakkında bilgi verebilir. Doğada dokusu olmayan yüzey yoktur. Dokunduğumuz bütün yüzeyler, bizde dokunsal etkiler uyandırırlar (Odabaşı, 1996, s69). Dolayısıyla dokunun algılamayı tamamlayıcı olması ve görsel, dokunsal hatta işitsel duyulara hitap etmesi ve bu duyuları tatmin edebilme gücüne sahip olması onun sanattaki kullanımını da oldukça önemli bir yere getirmektedir. Dijital doku, doğada bulunan doku örneklerinin bilgisayar gibi görüntü işlemeye müsait teknolojik ekipmanlarla yeniden yorumlanması, taklit edilmesi ve farklı kombinasyonlarla kullanılmasıdır. Günümüz teknolojisi sayısal ortamda tüm fiziksel ortamların neredeyse birebir simule edilmesine (taklit edilmesine) olanak sağlamaktadır. Sayısal ortamda doku, fotoğraflama ya da tarama aracılığıyla doğadan direkt alınabildiği gibi, kullanılan programların bünyelerinde bulunan dinamik fırça ve boyama araçları da dokuların doğadaki görüntüsünü taklit ederek de üretilebilmektedir. Dijital illüstrasyon araçlarının en başında gelen grafik çizim tabletleri, sanatçıya geleneksel yöntemlerle elde edebildiği birçok çizgisel ve lekesel doku uygulamalarını ekran üzerinde çizim yapabilen bir kalemle istediği etkileri ayarlayarak yapabilmesine olanak sağlamaktadır. Bu yöntemle artık sanatçılar tarama uçlarıyla, karakalem ve füzenlerle, guaj-suluboya-akrilik vb fırçalarıyla elde ettikleri dokuları sayısal ortamda da üretebilmektedirler. Elde edilen dokular dijital dekupe (kolaj) ya da birbirleriyle farklı karıştırma ve yedirme teknikleri ile istenilen alana uygulanır ve bu alanda karakteristik bir farklılık yaratılmak istenir. Günümüz illüstratif sinema afişlerinde bu uygulamalar çizim, boyama ve blok baskı (yüksek baskı; linol, ağaç ya da klişe baskı gibi) etkileriyle hissedilmektedirler.

Teknoloji ve Sanat bağlamında illüstratif sinema afişlerinde dijital dokuya 2018 yılı imzalı sinema afişlerinden örnekler ve incelemeler aşağıda sıralanmıştır;

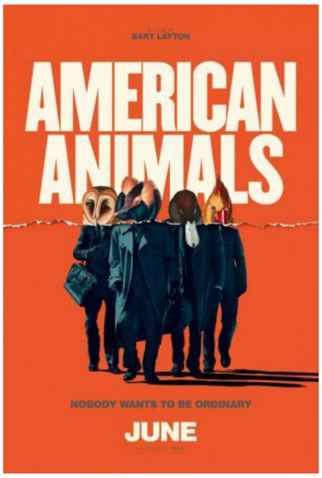
LA Lindeman & Associates tarafından hazırlanan 2018 yapımı "Acrimony" filminin afişine ait aşağıdaki iki örnekte farklı etkiler söz konusudur. Soldaki afişte marker çizim hissi verilen düz bir zemin üzerine uygulanmış çalakalem tarama yöntemiyle uygulanmış kadın portresinin kısmi silüeti yerleştirilmiştir. Keçeli kalemle yapılmış hissi verilen bu çizim, grafik tablet aracılığıyla uygun fırça seçimi yapılarak üretilmiştir. Ayrıca çizimde gözün altında yer alan kırmızı damga, Uzakdoğu baskı sanatçılarınca yaygın olarak kullanılan "hanko mühürleri"ne benzetilerek bütünlük sağlanmaya çalışılmıştır. Sağ tarafta yer alan afişteyse yer yer marker çizim etkisi yanında özellikle fonda kullanılan linol ya da ahşap baskı dokusu (özellikle baskıda oyularak temizlenen kısım) hissettirilmiş, Medusa figürün kafasında ise Antik Yunan vazolarında bulunan "Siyah Figür (Black Figures)" tekniğinin illüstrasyon sanatında sıkça kullanılan "figür içindeki detayların negatif çizimi" yöntemiyle yılan derisi dokusu işlenmiştir.

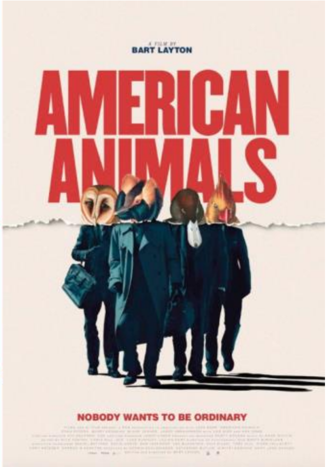




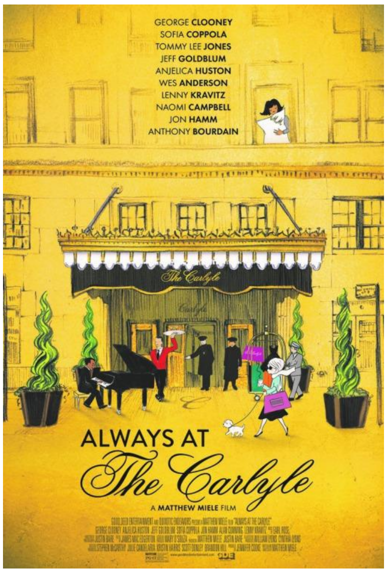
BLT Communication tarafından hazırlanan "Action Point" film afişinde ise, filmden bir çok sahnenin abartılarak bir arada resmedildiği bir fonda önünde tüm karakterler yer almaktadır. Karikatürleştirilerek çizilmiş afişin tamamında "air brush (boya tabancası)" etkisi bulunmaktadır. Bu etki izleyiciye en az doku hissi veren bir etki olsa da şeffaf renk geçişleri, üst üste atılmış şeffaf fırça darbeleri ve yedirmeler rahatlıkla seçilebilmektedir.

Empire Design tarafından tasarlanmış “American Animals” fimine ait her iki afişte de benzer etkiler bulunmaktadır. Yırtılmış kağıt etkisiyle ortadan dikeylemesine bölünmüş her iki afişte de figürler, zamanında guaş boyalarla resmedilerek yapılan eski afişlerdeki gibi resmedilmiş, kuru boya kalemlerle resmedilmiş hayvan figürleri taranarak portre kısımları bütünsel kolaj etkisiyle figürlere eklenmiştir. Kuru boya çizime has geçişli ve minik grenli doku, bu bölgede kendini hissettirirmektedir.





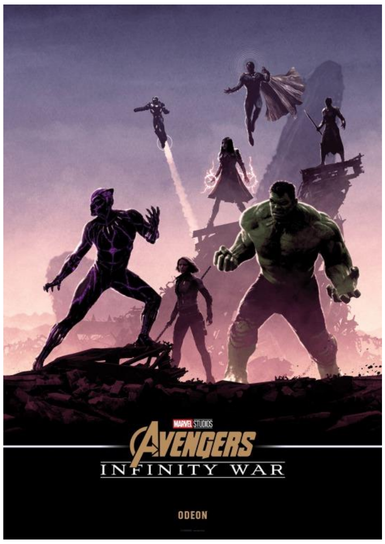
Authentik Creative Inc.’e ait olan “Always at The Carlyle” film afişi tamamen illüstratif etkilere sahip olup, alt kısımda üst üste bindirilen kağıt ve taş dokuları ve üst kısımda grenli bir dokunun kullanıldığı tek renk bir zemine sahiptir. Figürlerin bir kaçında bilinçli bir şekilde verilen kolaj etkisi hissedilmektedir. Fonda bulunan cephesel mimari çizimde gölgelerde verilen dikey tarama dokusu yer alırken bu gölgeler figürlerde perspektif kazanarak daha geçişli ve yumuşak bir hal alır.



Tasarımı Indika Entertainment Advertising’in olan “Anything” film afişi, genelinde farklı görüntü işleme programlarıyla elde edilebilen “suluboya” etkisine sahiptir. Kağıt dokusunu taklit eden iri yapılı grenler (gözenekler) afişin açık renkli kısımlarında daha çok belirgin olmakla birlikte fonda gece hissini veren yıldızlı yapıda yine suluboyada kullanılan “sıçratma ve damlatma” tekniği taklit edilmiş, alt kısımda ise su bazlı boya lekeleri ve akma efektlerine yer verilmiştir. Bu efektler geleneksel yöntemlerle yapılıp taranarak tasarımın üzerine eklenebildiği gibi dijital yöntemlerle de üretilebilmektedir.

Marvel firmasının genel bir hakimiyet kurma ve yapımlarını her kesime duyurabilme çabası sonucu neredeyse her bir Marvel yapımı filmin birden çok afişle beraber piyasaya çıkmaktadır. Marvel'in artık bir gelenek haline getirdiği "her bir karaktere için ayrı bir afiş" uygulaması, filmde yer alan tüm karakterler için ayrı birer afiş yapmaları ve dolayısıyla her bir karakteri ayrı ayrı tanıtabilmelerine olanak tanır.

Matt Ferguson imzalı "Avengers: Infinity War" filmine ait bir seri halinde çıkan afişlerden aşağıdaki iki örnek, eski Marvel çizgi roman kapaklarına gönderme yapmaktadır. Zeminde alt kısımda yer alan kayalık ve taşlık bölge ve arkada uzaklaştıkça solan fütüristik kalıntılar, dijital olarak resmedilerek yine dijital olarak dekupe edilip üst üste bindirilmiş, fonda sisli ve grenli bri doku kullanılmış, karakterlere ait figürler silüet olarak resmedilmiş fakat karakterlere ait doğa üstü güçler yıldırım, duman, gölge, patlama partikülleri dokularıyla belli edilmiştir.



"Acts of Violence" filmine ait Kustom Creative tasarımlı afişte, başrol oyuncularının fotoğrafları zeminde kontrastlı bir şekilde kullanılmış, gölgeleri ve ışıklı alan etkileri bölgesel HDR (High Dynamic Range / Yüksek Dinamik Aralığı) tekniğiyle abartılarak aksiyon filmlerine has patlama, duman ve uçuşan partiküller gibi dokular bu figürlerin etrafında kullanılmıştır.

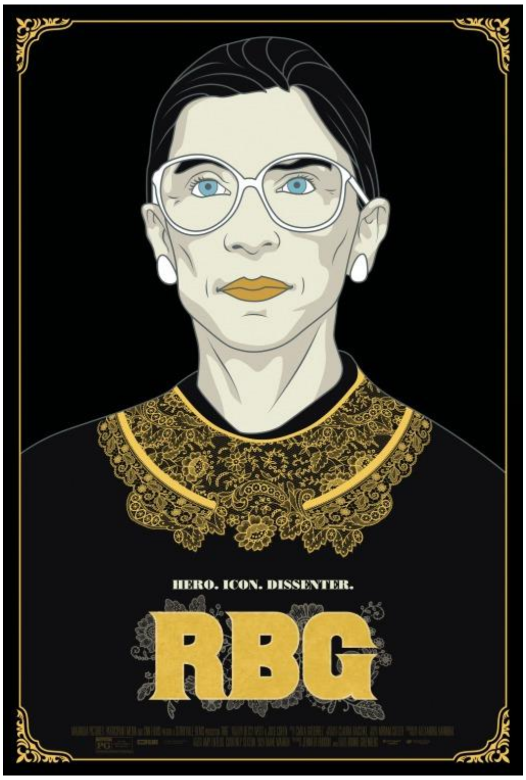
Tasarımı Tom Hodge'a ait "Beats of Rage" filminin afişi 2018 yapımı olmasına rağmen tamamen 90'lar etkisi taşımaktadır. Pembe ve mavi neon bir atmosfere hakim olan afişte karakterler abartılı kontrast ve parlaklıkla resmedilmiş, zeminde ve arkada bilgisayar dünyasına gönderme yapan neon teknolojik dokular yerleştirilmiş ve yine çizgi romanlarda sıkça kullanılan yıldırım, fişek ve patlama gibi olgularla karakterlere insanüstü güçlere sahip izlenimi verilmiştir.

Yine bir Marvel yapımı olan "Black Panther" film afişlerinden aşağıda verilen örnek, LA Lindeman & Associates imzalı, genelinde suluboya ve mürekkep izlerini taşıyan bir çalışmadır. Zeminde kaba dokulu bir kağıt dokusunun kullanıldığı afişte, monokrom (tek renkli) suluboyayla yapılmış hissi veren bir figür etrafında "Sumi-e (Japon Mürekkeple Resmetme Sanatı)" çalışmalara has mürekkep damlaları ve suyla erimiş hissi veren efektler kullanılmış, figürün alt kısmında yine "Dry Brush (Kuru Fırça)" tekniğine benzer fırça dokuları kullanılarak figür bitirilmiştir. Bu etkilerin tamamı, ArtRage, Corel Painter gibi ileri düzey dijital resimleme programları aracılığıyla yapılabilmektedir.

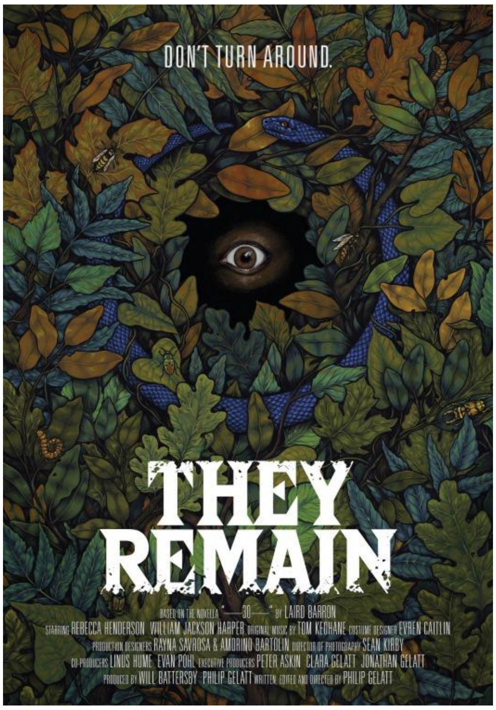
Birçok afişte imzası olan "LA Lindeman & Associates" firmasına ait "The Commuter" film afişleri, yüksek baskı teknikleriyle yapılmış hissi veren bir seri olarak çıkarılmıştır. Aşağıda verilen afişlerin tümünde sınırlı renkler kullanılmış, figür ve objeler şablon olarak yerleştirilmiştir. Şablonlarda bilinçli bir şekilde oluşturulan düzensiz kesilmiş hissi vardır. Dijital dekupe ve alan boyama tekniğiyle yapılmış bu alanlarda farklı gözenekli dokular kullanılarak afişler linol baskı gibi bir yüksek baskı tekniğiyle çoğaltılmış etkisi verilmiştir. Bahsedilen doku, fiziksel olarak yüksek baskı kalıbının dokulu bir kağıdın yüzeyine yüzde yüz baskı yapamaması ve dolayısıyla mükemmel bir iz bırakmaksızın gözenekli açıklıklara sebep olmasıyla oluşmaktayken, dijital ortamda bu tarama yoluyla koyu renk blok baskı yapılmış kağıtlardan ya da yine farklı fırça ve etkilerle üretilebilmektedir.

Grafik sanatçısı Joanna Newman ve illüstratör David Bell'in ortak yapımı olan "Imitation Girl" film afişi, neon renklerine sahip geçişlere ve karakaleme benzer alt çizimlere sahip bir çalışma. Rotoskopa benzer (fotoğraf referanslı çizim) bir tarza sahip kadın figürleri, gölgelerinde karakalem taramalara benzer bir dokuya sahip. Figürlerin arkalarında yer alan daire içinde ise kraterli ay yüzeyi bindirilmiş, yine farklı alanların dalgalar şeklinde daha açık tonlarda kapatılmasıyla akışkan bir doku oluşturulmuş. Buradaki dokuya Japonların "Washi" kağıtlarındakine benzer bir doku olduğunu söyleyebiliriz. En arka fonda ise iri ve aralıklı grenler, yıldızlar olarak yerleştirilmiştir. Alt kısımda çöl etkisi biririni tekrar eden çizgisel dalgalı dokulu alana perspektif verilerek yapılmıştır.

Gravillis Inc. tarafınca hazırlanan "RBG" filmine ait afişte, fotoğraf referanslı dijital çizim bir kadın portresi mevcut. Figürün yakasında afişin köşelerinde yer alan dekoratif motifleri tamamlayıcı orient (doğuya özgü) dokular kullanılmıştır. Bu tarz geçmeli ve örmeli dokular, birbirini otomatik tamamlayıcı çizim özelliği bulunan dijital çizim programlarıyla ayrıca çalışılıp istenilen bölgeye dijital dekupe edilerek eklenebilmektedir.



Sanatçı Jeanne D'Angelo'nun keltik çizimlerle bezediği "The Remain" film afişinde bitki ve yaprak örüntüsü geniş bir yer kaplamaktadır. Birbirine çok yakın tonlarla resmedilen yapraklarda doğada kendilerine has olan dokular işlenmiştir. Yaprakların bir daire biçiminde aralık bıraktığı açıklığı çevreleyen çember bir şekilde resmedilmiş mavi yılan, üzerinde lozenge (baklava dilimi) tekrarlarla oluşturulmuş bir deriye sahiptir.



Sonuç

Sonuç olarak verilen örneklerle de görüldüğü üzere afişlerde kullanılan illüstrasyonda geleneksel illüstrasyon tekniklerinde uygulanabilen hemen hemen tüm doku uygulamaları kullanılmaktadır. Grafik tablet ve basınca duyarlı kalem kombinasyonuyla illüstrasyon sanatçıları, kağıt üzerinde çalışır gibi fiziksel bütün çizim ortamlarını bilgisayara taşıyabilmektedirler. Bilgisayar aracılığıyla yapılan tasarımda geleneksel yöntemleri tamamen terk etme söz konusu olmamış, geleneksel yöntemlerle yapılmış doku ve çizimlerin dijital ortama aktarılarak yeniden işlenmesiyle farklı sentezler ortaya çıkmıştır. Dijital ortamın kullanıcıya sunduğu hızlı işlem yapabilme, hataları geri alabilme, çarpıcı kontrast ve netlikte ürün çıkarabilme ve aynı anda birden farklı kombinasyonu bir arada görebilme gibi imkanlar, sanatçılara daha özgün ve modern tasarımlar çıkarmalarına katkıda bulunmuştur.

Kaynakça

Becer, E. (1997). "İletişim ve Grafik". (1). Ankara: Dost Kitapevi.

Çakmak, S. (2010). "İki Boyutlu Eğitici Animasyonlar ile Eğitici Yayın İllüstrasyonlarının Karşılaştırılması ve 10-12 Yaş Öğrencilerinin Öğrenmelerine Etkisi ", Konya: Selçuk Üniversitesi Sosyal Bilimler Enstitüsü, Yüksek Lisans Tezi.

Çam, Tekin A. (2012). "İllüstrasyon: Cilt:1", İstanbul: Alternatif yayıncılık.

Doğan, S. (2009). "Türk Sinemasında İllüstratif Afişler", Ankara Üniversitesi, Yüksek Lisans Tezi, Ankara.

Ertan G., Sansarcı E. (2017). "Görsel Sanatlarda Anlam ve Algı", 2. Baskı, Alternatif Yayıncılık-Yayın Evi Genel Dizisi.

İncearık, M. (2011). "Grafik Tasarım Rehberi. (1)". İstanbul: Kodlab Yayın Dağıtım.

Kaptan, A. Y. (1996). "Afişte İllüstrasyonun Yeri ve Önemi". Yüksek Lisans Tezi. Samsun: Ondokuz Mayıs Üniversitesi, Sosyal Bilimler Enstitüsü, Resim-İş Eğitimi Anasanat Dalı.

Karadağ, Ç. (2003). "Görme Kültürü: Fotoğrafın Derin Anlamı", 3. Kitap Doruk Yayımcılık, İstanbul.

Odabaşi H. (1996). "Grafikte Temel Tasarım". Yorum Sanat Ve Yayıncılık, İstanbul.

Öztuna, Yakup, (2007). Grafik Tasarım Dergisi No: 6 "Uluslararası Modern Tasarım".
Pektaş, H. (1988). "Basın İlânlarında Grafik Tasarımın Yeri ve Önemi, Bir Basın İlânı Tasarımı". Yüksek Lisans Tezi. Ankara: Hacettepe Üniversitesi, Sosyal Bilimler Enstitüsü, Uygulamalı Sanatlar Ana Sanat Dalı.
Tepecik, A. (2002). "Grafik Sanatlar", Ankara: Detay Sistem Ofset.
Yaman, Ekim, Sungur, Özer. (2014). "Çağdaş Dünya Sanatı 12. (5). Saray Matbaacılık, Ankara.

İnternet: Karakaya, S. (2005). Sinema Resim İlişkisi ve Sanat Olarak Sinemanın Resimsel Estetiği Elektronik Sosyal Bilimler Dergisi: http://dergipark.ulakbim.gov.tr/esosder/article/view/5000067977 adresinden 19 Nisan 2018'de alınmıştır.

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Using Computer Tecnology Education Faculties At Graphic Training In Art And Handwork Departments Of Education Faculties

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Abstract: Today, science and technology develops so fast that it is almost impossible to catch up with. The consumer of this technology is always humankind. Art, different from technology, reflects the aesthetic perspective of human soul. It has never had the purpose of making life easier. Through different periods of life, artists used the materials they could find while creating their masterpiece. In every period art works are created with different materials and different formats. As a branch of art, graph has also been affected from technological products in different time periods. Visual communication, which is the reason of existence of graph work today, has been carried to enourmous levels in design and application. Many works that used to be done manually are now prepared in computers easily. And even, every level of graph works, from design to print, are prepared with computer technology. With the development of science and technology, education has been through important changes also. This change has been in material use and in different teaching techniques. Through this study, we try to find answers for "how we get used to these changes and developments in art education and technology", "what do the students think about these?", "what is the situation at hand?".

Keywords: Art, Education, Computer Technology

Eğitim Fakülteleri Resim-İş Öğretmenliği Bölümlerinde Grafik Eğitiminde Bilgisayar ve Baski Teknolojisinin Kullanimi

Özet: Günümüzde bilim, teknoloji gelişim hızı bakımından karşı koyulamaz bir şekilde ilerlemektedir. Bu teknolojik gelişimin her zaman tüketicisi de insandır. Sanat ise teknolojiden farklı olarak insan ruhunun estetik bakış açısını yansıtır. Hiç bir zaman yaşamı kolaylaştırmak gibi bir kaygısı olmamıştır. Tarihin farklı dönemlerinde sanatçılar ortaya koydukları eserleri yaparken o günün şartlarında temin edebildikleri malzemeleri kullanmıştır. Her dönemde sanat çalışmaları farklı biçimlerde, farklı malzemelerle ortaya konmuştur.Sanat alanının bir kolu olan grafik de farklı dönemlerde teknoloji ürünlerinden etkilenmiştir. Günümüzde grafik çalışmalarının var oluş sebebi olan görsel iletişim, biçim noktasında tasarım ve uygulamada çok farklı noktalara taşınmıştır. Geçmişte el yordamıyla yapılan birçok çalışma günümüzde artık bilgisayar ortamında kolayca hazırlanabilmektedir. Grafik çalışmalarının tasarımdan basım sürecine kadar ki bütün aşamaları bilgisayar ortamlarında hazırlanmaktadır. Eğitimde de bilim ve teknolojinin gelişmesiyle önemli değişimler olmuştur. Bu değişim, hem materyal kullanımı hem de farklı öğretim yöntemleri açısından olmuştur. Bu çalışma ile bütün bu sanat eğitimi ve teknoloji alanındaki gelişim ve değişimlere biz nasıl uyum sağlıyoruz, bunlar hakkında öğrenciler ne düşünüyor, var olan durum nedir sorularına yanıtlar aranmıştır. Eğitimin alıcıları olan öğrencilere anket uygulaması yapılarak soruların cevapları alınmıştır. Sonuç olarak ortaya çıkan araştırma bulguları değerlendirilmiştir.

Anahtar Kelimeler: Sanat, Eğitim, Bilgisayar Teknolojisi.

Giriş

İnsanoğlu dünyaya ilk ayak bastığından itibaren iletişim kavramıyla tanışmıştır. Seslerle, işaretlerle, çizgilerle, harflerle, rakamlarla, şekillerle, resimlerle derken ortaya üzerinde önemle durulması gereken bir iletişim alanı çıkmıştır. İnsanoğlu zaman içerisinde bunlara ruhunda var olan estetiği de katmış ve ortaya bir görsel iletişim sanatı olan grafik sanatlar kavramı çıkmıştır.

Grafik tasarım kavramı 20.yüzyılda metal kalıplarla basılarak çoğaltılan görsel materyaller için kullanılmaya başlanmış fakat teknoloji geliştikçe sadece basılı malzemeler değil; film aracılığıyla perdeye yansıtılan görüntüler, video ile ekrana gönderilen ve bilgisayarlar yardımıyla üretilen görsel malzemelerin grafik tasarım kapsamı içine girmesiyle bu terimin anlamı oldukça genişlemiştir (Becer,2005).

Çok geniş bir alanı kapsayan bu sanat dalı temelde güzel sanatların uygulamalı sanatlarla ve yeni teknolojilerle buluştuğu bir alandır. Bir başka deyişle grafik sanatlar teknolojik olanakları kullanarak görsel ögelerden bir iletişim dili yaratır (Odabaşı,2002).

Gelişen teknolojinin sunduğu olanaklar yaşama biçimimizi değiştirirken çağdaş sanatta, sanatçının işlevi ve konumunda da büyük değişiklikler olmuştur. Çağımızın en büyük sorunu teknoloji insan ilişkisini dengeleyebilmek olmuştur. Sanat bu dengeleme araçlarından biri olup bireyi parçalanmış durumdan bütüne dönüştürerek, düşünmeye, öğrenmeye ve kendini yetiştirmeye özendirmektedir (Bengisu,2000).

Sanat ve teknoloji grafik tasarım alanında artık bir bütün haline gelmiştir. Birçok zorlanmaya rağmen bilgisayar teknolojileri sunduğu yeni anlatım olanaklarıyla sanat alanında yayın olarak kullanılır hale gelmiştir. Günümüzde sanat eğitimi veren kurumlarda durumun ne olduğu bu manada önem kazanmıştır.

Araştırmanın Amacı

Bu araştırmada Eğitim Fakültelerinin Resim-İş Eğitimi Bilim Dallarında grafik tasarım öğeleri, tasarlama aşamaları ve uygulamalarının ne şekilde yapıldığı; bilgisayar ve baskı teknolojilerinin hangi düzeyde kullanıldığı araştırılmıştır.

Sözü edilen anlayış ve sorunların sebeplerini araştırmak ve grafik eğitiminde daha iyiye nasıl gidilebileceği noktasında önem taşımaktadır.

Grafik Tasarım ve Teknoloji

Grafik tasarımın amacı, etkili görsel iletişim ürünlerinin oluşturulmasıdır. Yazıların ve görsel materyallerin (fotoğraf, illüstrasyon vb.) düzenlenmesi ve ardından basılı ürünler oluşturulması grafik tasarımın en yaygın uygulamalarıdır. Geçmişten günümüze kadar yapılan grafik uygulamalarında grafik sanatçıları çağın getirdiği imkân ve olanakları kullanmışlardır. Her dönemde teknoloji, teknik anlamda yapılan çalışmalara yansımıştır. Birçok sektörde olduğu gibi teknolojik gelişimin öncüsü olarak görülen bilgisayar sistemleri zamanla grafik sanatçılarının da hayatına girmiştir.

Hızla gelişen ve her alanda kendisine yer bulan bilgisayar teknolojisinden en fazla etkilenen sektörlerden birisi de basım sektörüdür. 20 yıl öncesine kadar bu alanda tamamıyla manuel ve fotografik yöntemler kullanılarak oldukça uzun zamanda büyük emekler harcanarak baskıya hazır hale getirilen çalışmalar, günümüzde masaüstü yayıncılık sistemleri ile kısa zamanda ve kolaylıkla basılabilir hale gelmiştir(Mazlum,2006).

Masaüstü Yayincilik

Masaüstü yayıncılık terimi, İngilizce DTP (Desktop-Publishing,) teriminin Türkçe karşılığı olarak kullanılır. Anlam olarak, "masa başında yayıncılık" anlamına gelmesine rağmen, dilimize, kelime çevirisi yapılarak girmiş ve masaüstü yayıncılık olarak çevrilmiştir.

Mazlum (2006) masaüstü yayıncılığı, genel anlamıyla çoğaltılması amaçlanan grafik ürünlerin {kitap, dergi, broşür vb.), bilgisayar ve tamamlayıcı sistemler ile (yazılım, çıkış cihazı, tarayıcı...) basılabilir hale getirilmesi olarak tanımlamıştır. Diğer bir deyişle; basılacak üründeki metin, fotoğraf, tablo, illüstrasyon vb. elemanların uygun yazılımlar kullanılarak bilgisayar ortamında tasarım uygulamalarının yapılmasıdır. Becer'e (2005) göre de günümüzde masaüstü yayıncılık teknolojisi, bir tasarımın baskıya hazır hale getirilme sürecini oldukça kısaltmış ve kolaylaştırmıştır. Bilgisayar ekranı çizim yüzeyi haline gelmiştir. Bazı özel çalışmalar dışında, artık rapidolara, mürekkeplere, yapıştırıcılara ve kağıtlara gerek kalmamıştır. Ekran üzerinde hazırlanan tasarımlardan kağıt veya film halinde çıktı, ya da renk ayrımı alınabilmekte, bu çıktılar doğrudan baskı kalıbının hazırlanmasında kullanılabilmektedir.

Bilgisayarlar ve diğer masaüstü yayıncılık cihazları, tasarım uygulama sürecinde grafikerlere sınırsız olanaklar sunmakta ve tasarımların kısa sürede, kolaylıkla ve mükemmel bir şekilde yapılmasına imkân tanımaktadır. Bununla birlikte, masaüstü yayıncılık sistemlerini tanıma, etkin kullanabilme ve gelişmeleri takip etme zorunluluğu doğmaktadır

Bilgisayar ve masaüstü yayıncılık araçları tasarımcıların uygulamalarını kolaylaştıran sistemlerdir. Kullanıcısına seçenekler gösterebilen bu sistemler; tasarımın hazırlığı, farklı seçenekler oluşturulması, yani düzenlemelerin uygulamaya geçilmeden görselleştirilebilmesi noktasında hayal gücünün sınırlarını zorlayabilmektedir. Fakat işin estetik ve sanatsal boyutu duyumlarla alakalıdır, düşünsel bir süreçtir. Bilgisayarlar bu aşamada işlevini yitirmekte; tasarımda sanat, tasarım ve estetik öğeler ön plana çıkmaktadır.

Yöntem

Anket araştırmasının amacı; sanat eğitimi alan öğrencilerin bilgisayar ve baskı teknolojilerinin sanat eğitim-öğretim etkinliklerinde kullanılmasına ilişkin görüş ve tutumlarını ortaya koymaktır. Araştırmanın modeli genel tarama modelidir.

Araştırma, Selçuk Üniversitesi, Gazi Üniversitesi, Fırat Üniversitesi, Dicle Üniversitesi, İnönü Üniversitesi, Pamukkale Üniversitesi ve Niğde Üniversitesi, Eğitim Fakülteleri Resim-İş Eğitimi Bilim Dallarında 2006/2007 Eğitim Öğretim yılında eğitim-öğrenim gören toplamı 276 olan 3. ve 4. sınıf öğrencileri ile sınırlıdır. Öğrencilerin bilgisayar ve baskı teknolojileri hakkındaki görüşlerini ortaya çıkarmak için anket formu kullanılmıştır.

Bulgular ve Yorum

Bilgisayar ve Baskı Teknolojilerinin Eğitim Öğretim Etkinliklerinde Kullanılmasıyla İlgili Öğrenci Görüşleri

Bu bölümde öğrencilerin bilgisayar ve baskı teknolojilerinin eğitim öğretim etkinliklerinde kullanım durumuyla ilgili görüşlerine yer verilmiştir.

Deneklerin Kişisel Bilgisayara Sahip Olma Dağılımı

Deneklerin kişisel bilgisayar sahibi olup olmamalarına ilişkin dağılım Tablo 7'de yer almaktadır. Deneklerin tamamı ilgiyi soruyu yanıtlamışlardır. Deneklerin bilgisayar sahibi olma durumları incelendiğinde dengeli bir dağılımdan söz etmek mümkündür. Buna göre katılımcıların % 50,7'si kişisel bir bilgisayara sahip olduğunu ifade ederken, % 49,3'ü de kişisel bir bilgisayara sahip olmadığını belirtmiştir.

Deneklerin Bilgisayar Kullanma Süreleri

Katılımcıların bilgisayar kullanma sürelerini sorgulayan soru deneklerin % 98,6'sı tarafından yanıtlanmıştır. Tablo 8'de de görüldüğü gibi katılımcıların % 47,1'i bilgisayar kullanma süresine ilişkin 1-3 yıl kategorisini belirtirlerken, % 27,6'sı 4-6 yıl, % 21,3'ü 7-10 yıl ve % 4'ü de 11 yıl ve üzeri kategorilerini ifade etmişlerdir. Bu dağılıma göre katılımcıların yarıya yakın kısmı 1-3 yıl aralığına karşılık gelen süre boyunca bilgisayar kullanmaktadırlar.

Deneklerin Kullandıkları Bilgisayar Sistemi

"Hangi bilgisayar sistemini kullanıyorsunuz?" sorusunu katılımcıların % 92'si yanıtlamışlardır. Tablo 9'da yer alan dağılıma göre katılımcıların % 89,4'ü PC, % 7,5'i, Macintosh kullanmaktadırlar. Diğer yandan katılımcıların % 3,1'i de her iki sistemi de kullandığını ifade etmiştir.

Ders Dışı Faaliyetlerde Bilgisayar Kullanımı

Katılımcıların ders dışı faaliyetlerinde bilgisayar kullanıp kullanmadıklarına ilişkin soruya verilen yanıtlarda ise "evet" yanıtının oranı oldukça dikkat çekici düzeydedir. İlgili soruya % 99,6 oranında yanıt alınmıştır. Tablo 10'da da görüldüğü gibi çalışmaya katılan öğrencilerin % 85,5'i ders dışı faaliyetlerinde bilgisayar kullandıklarını, % 14,5'i de kullanmadıklarını belirtmişlerdir.

Bilgisayar Laboratuarı

Çalışma kapsamında öğrencilere yöneltilen bir diğer soru da "Eğitim aldığınız kurumda grafik eğitimine yönelik derslerde kullanılan bir bilgisayar laboratuarı var mı?" sorusudur. İlgili soruya öğrencilerin % 99,3'ü yanıt vermişlerdir. Tablo 11'de de görüldüğü gibi, öğrencilerin % 64,2'si okullarında derslerde kullanılan bir bilgisayar laboratuarının olduğunu belirtirlerken, % 35,8'i de böyle bir laboratuara sahip olmadıklarını ifade etmişlerdir.

Grafik Ana Sanat Atölye Dersinin Alındığı Yer

Öğrencilerin Grafik Ana Sanat Atölye dersini nerede aldıklarına ilişkin soruya verilen yanıtlar Tablo 12'de yer almaktadır. İlgili soruya deneklerin % 88,4'ü yanıt vermişlerdir. Buna göre öğrencilerin % 75,8'i söz konusu dersi grafik atölyesinde alırken, % 7,4'ü de bilgisayar laboratuarında almaktadırlar. Ayrıca öğrencilerin % 16,8'i bu dersi hem grafik atölyesinde hem de bilgisayar laboratuarında aldıklarını belirtmişlerdir.

Grafik Ana Sanat Atölye Dersiyle İlgili Çalışmalarda Bilgisayar ve Baskı Teknolojilerinden Faydalanma

Öğrencilerin grafik ana sanat atölye dersiyle ilgili çalışmalarda bilgisayar ve baskı teknolojilerinden faydalanıp faydalanmadığı araştırmada öğrencilere yöneltilen sorulardan biridir. İlgili soru araştırmaya katılan öğrencilerin % 91,7'si tarafından yanıtlanmıştır. Tablo 13'de yer alan dağılıma göre öğrencilerin % 61,3'ü bu çalışmalarda bilgisayar ve baskı teknolojilerinden faydalanırken, % 38,7'si de faydalanmamaktadır.

Grafik Eğitimi Dışındaki Derslerde Bilgisayar ve Baskı Teknolojilerinden Faydalanma

Öğrencilerin bilgisayar ve baskı teknolojilerinden grafik eğitimi dışındaki derslerde faydalanıp faydalanmadıklarını sorgulayan soruya öğrencilerin % 93,1'i yanıt vermişlerdir. Tablo 14'de yer alan dağılıma göre çalışmaya katılan öğrencilerin % 52,9'u grafik eğitimi dışındaki derslerde bilgisayar ve baskı teknolojilerinden faydalanırlarken, % 47,1'i de faydalanmamaktadırlar.

Bilgisayar Teknolojilerinin Grafik Ana Sanat Atölye Derslerinde Öğretim Elemanları Tarafından Kullanılması

Bilgisayar teknolojilerinin grafik ana sanat atölye derslerinde öğretim elemanları tarafından kullanılıp kullanılmadığını sorgulayan soru, çalışmaya katılan öğrencilerin % 89,9'u tarafından yanıtlanmıştır. Tablo 15'de ayrıntıları yer alan dağılıma göre deneklerin % 59,7'si öğretim elemanlarının bu teknolojileri grafik ana sanat atölye derslerinde kullandıklarını belirtirlerken, % 40,3'ü de kullanmadıklarını belirtmişlerdir.

Sonuç

Araştırmada Türkiye genelinden seçilen farklı bölgelerdeki yedi farklı üniversitenin Eğitim Fakülteleri, Resim-İş Eğitimi Bilim Dallarında okuyan öğrencilere anket uygulanmıştır. Anket çalışması uygulanan öğrencilerin bilgisayar ve baskı teknolojilerini gerek okul içi gerek okul dışı faaliyetlerde ne kadar kullandıkları sorularla anlaşılmaya çalışılmıştır.

Öğrencilerin 50,7'si bilgisayarı olduğu cevabını verirken diğerleri olmadığını belirtmiştir. Kullandıkları bilgisayar sistemleri sorusuna %82,2'si büyük bir oranla çevremizde sıkça da kullanılan PC sistemleri kullandığını belirtmiştir. Günümüzde grafik tasarım sektöründe çalışmalar hazırlanırken Macintosh sistemlerin yoğun kullanıldığı düşünülürse öğrencilerdeki %6,9'luk Macintosh sistem kullanımı oran olarak yetersiz olduğu düşünülebilir.

Okullar da grafik eğitimine yönelik bilgisayar laboratuarının olduğu sorusuna verilen cevaplarda %63,8'i hayır cevabını vermiştir. Diğerleri ise olduğunu belirtmişlerdir. Bu soruya verilen cevapların okullara göre dağılımına baktığımızda ise Fırat Üniversitesi, Gazi Üniversitesi ve Dicle Üniversite'sin de grafik derslerinde kullanılan bir laboratuarı olduğu, Selçuk Üniversitesi, Niğde Üniversitesi, Pamukkale Üniversitesi ve İnönü Üniversitesinde ise dersler için kullanılan bir laboratuar olmadığı anlaşılmıştır. Fakat anket sonuçları detaylı incelendiğinde aynı öğrenciler derslerin çoğunlukla (%67,2) grafik atölyesinde işlendiğini belirtmiş, her ikisi diyenler(%14,9),sadece bilgisayar laboratuarı diyenler (%6,5)'te kalmıştır. Bu veriler ışığında bilgisayar laboratuarı olan okullarda da dersler yoğunlukla atölyelerde işlenmektedir. Bunun sebep öğrenci sayısına göre laboratuarların yetersiz kalması, bilgisayar destekli grafik tasarım derslerini verebilecek öğretim elemanlarının bulunmaması, ders programlarının yetersiz kalması gibi nedenler olabileceği düşünülmektedir.

Ders dışı faaliyetlerde bilgisayar kullanımına bakıldığında öğrencelerin (%85,1)'i evet yanıtı vermiştir. Öğrencilerin bu sonuca göre sıklıkla bilgisayar kullandıkları görülmektedir. Aynı öğrencilerin bilgisayar teknolojilerini grafik atölye çalışmalarını hazırlarken kullanıp kullanmadıkları sorusu için verdikleri cevaplardan anlaşılmıştır ki; bilgisayar teknolojilerinin derslerde kullanımı yetersizde olsa, öğrenciler kendi çalışmalarını ders dışında hazırlarken bu teknolojilerden faydalanmaktadır. Günümüz şartlarında bu durumun her ders için geçerli olduğunu söylenebilir. Fakat bunun doğru olmadığı da öğrencilerin grafik dışındaki derslerde bilgisayarı aynı oranda kullanmadıklarını belirtmelerinden anlaşılmıştır.

Çalışma içinde dikkat çekici noktalardan biride öğrencilerin okullarında bilgisayar büyük oranda laboratuarı olmamasına karşın öğretim elemanlarının grafik eğitimi derslerinde bu teknolojilerden faydalanması durumudur.

Yaşadığımız çağın gerçekleriyle öğrencilerimizi yüzleştirebildiğimiz ölçüde, verdiğimiz sanat eğitimi anlamlı olacaktır. Akılcı, çağdaş, fiziksel kaynakları yerinde ve tam kullanabilen, araştırmacı bireylere ve bunları destekleyen kurumlara ihtiyaç vardır. Grafik eğitimi veren kurum ve kuruluşlar, piyasayla sürekli iletişim ve etkileşim içerisinde olmalıdır. Çünkü grafik eğitimi sürekli gelişen teknolojik gelişmelerle iç içe olan ve kendini sürekli yenileyen bir sanat dalıdır.

Kaynakça

Becer, Emre.(2005). İletişim ve Grafik Tasarım. Ankara: Dost Kitabevi.

Bengisu,Hatice. (2000). Bilgi Çağı ve Sanatın Gerekliliği. VI.Ulusal Sanat Sempozyumu. Ankara: Hacettepe Fakültesi Yayınları.

Mazlum, Fehmi Soner. (2006). Masaüstü yayıncılık. Ankara: Gazi Kitabevi.

Odabaşi, Hatice Aslan. (2002).Grafikte Temel Tasarım. İstanbul: Yorum Sanat Yayınları.

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