

Boğaziçi University
SCED Graduate Student Research Symposium

Date: October 23, 2021
13.00- 15.00

ABSTRACT BOOK

The Department of Mathematics and Science Education (SCED) are pleased to announce Boğaziçi University SCED Graduate Student Research Symposium. Our goal is to showcase the quality and diversity of graduate-level research at our department. Our graduate students will present their posters during the Symposium.

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9- Effect of Technology-Based Instruction on Fifth Grade Students' Spatial Ability and Geometry Achievement

Sanem Sarılıcan, Sevil Akaygün

Supporting Pre-service Mathematics Teachers' Attending to Students' Proportional Reasoning

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In recent years, with the increasing importance given to noticing students' thinking and designing and implementing instruction accordingly, noticing skill has been accepted as one of the basic skills teachers should be equipped with (Meschede, Fiebranz, Möller, & Steffensky, 2017). More specifically, teachers' ability to notice students' mathematical thinking (Jacobs, Lamb, & Philipp, 2010) has been conceptualized as three interrelated skills: paying attention to students' thinking, interpreting students' thinking, and deciding how to respond based on these interpretations. Considering that teachers' noticing skill is affected by their mathematical content knowledge and their knowledge of students' mathematical thinking (Meschede et al., 2017), pre-service teachers' training on noticing students' thinking in different mathematical areas may support their noticing in a more meaningful way.

In this study, researchers are aiming to investigate the influence of a program designed for developing pre-service teachers' noticing of students' proportional reasoning on pre-service teachers' attention to students' thinking. For this purpose, a 7-week online training for 2 hours a week is given to 16 pre-service teachers studying at a state university. The main focal points of the training are: i) to conduct a clinical interview with a 6th or 7th-grade student in the context of proportionality problems, ii) to analyze and interpret the proportional reasoning patterns of the students through this interview, and iii) to make instructional decisions based on this information. In this study, the dimension, attending to students' thinking was analyzed qualitatively through a comparison of pre and post-assessment. The preliminary findings reveal that the majority of pre-service teachers have improved in terms of their ability to pay attention to the proportional thinking styles and solution strategies of the students. When the data obtained from the pre-assessment and post-assessment of the pre-service teachers' attending

skill were compared, qualitative changes and improvements were observed in the post-assessment. The quantitative analysis of attention dimension is on the progress.

In the presentation, the content of the training program, examples of observed changes, the qualitative and quantitative changes in attention dimension, and the strengths and weaknesses of pre-service teachers in terms of their ability to pay attention and further routes for development will be elaborated on.

Keywords: noticing skills, attending to student thinking, proportional reasoning.

References:

Jacobs, V. R., Lamb, L. L., & Philipp, R. A. (2010). Professional noticing of children's mathematical thinking. *Journal for Research in Mathematics Education*, 169-202. https://doi.org/10.5951/jresematheduc.41.2.0169

Meschede, N., Fiebranz, A., Möller, K., & Steffensky, M. (2017). Teachers' professional vision, pedagogical content knowledge and beliefs: On its relation and differences between pre-service and in-service teachers. *Teaching and Teacher Education*, *66*, 158-170. https://doi.org/10.1016/j.tate.2017.04.010

A Content Analysis of the Representation of Nature of Science in Turkish Science Textbooks

Beyza Okan, Ebru Kaya

Reconceptualized Family Resemblance Approach to NOS (RFN) is one of the approaches of nature of science (NOS). This study is a part of the funded project examining the representation of NOS in science textbooks. Eight-grade science textbook which is given freely by the Ministry of National Education (MoNE) was selected purposively for this study. The coding units were specified as content, activity, and assessment sections in the textbook. These units were traced based on RFN including 11 categories of science which are the aims and values (AV), scientific practices (SP), methods and methodological rules (M), scientific knowledge (SK), social certification and dissemination (SCD), professional activities (PA), scientific ethos (SE), social values (SV), social organizations and interactions (SOI), financial systems (FS), and political power structures (PPS). The codes were generated and grouped for each category. The results show that the frequencies of the codes for each RFN category are 24, 231, 41, 23, 38, 29, 1, 16, 11, 4, and 9 respectively. Besides, the frequencies of the codes for content, activity, and assessment sections are 124, 280, and 23 out of 427 respectively. The frequency of the codes under the SP, M, SCD, PA is found most in the activities sections of the textbook whereas AV, SK, SE, SV, FS, and PPS were represented most in the content sections of the textbook. In general, although there are some references to NOS in 8^{th} grade science textbook the representation of NOS is insufficient and poor in the whole textbook.

How Do Science Teachers From Different Career Stages Perceive The Nature of Science?

Busra Aksoz, Ebru Kaya, Sibel Erduran

The paper reports about a funded research project that examines science teachers' understanding of the nature of science (NOS). It focuses on the effect of teachers' teaching experiences and education levels using the Family Resemblance Approach (FRA) to Nature of Science (NOS)" (Irzik & Nola, 2014; Erduran & Dagher, 2014). FRA has been described by Erduran and Dagher (2014) as a framework that outlines NOS as an epistemic-cognitive and social-institutional system. To distinguish its educational dimension from the previous version of the FRA framework, Kaya and Erduran (2016) used the term "RFN" for "Reconceptualized Family Resemblance Approach (FRA) to Nature of Science (NOS)". A total of 170 science teachers from different educational levels (undergraduate and graduate) and teaching experiences (0-5 years to 16 and above) participated in the study that aimed to trace their perceptions of RFN categories. The online version of the RFN Questionnaire (Kaya, Erduran, Aksoz, & Akgun, 2019) including 70 items with 5-Likert type was used. Descriptive analysis showed that that science teachers have between moderate to a high-level understanding of RFN categories. The analysis of the Kruskal-Wallis Test indicated that there is no significant difference in the medians of Total RFN scores with respect to teachers' educational levels. However, the Mann-Whitney U test showed that there is a significant difference in the median of Total RFN scores with respect to teachers' teaching experiences. In terms of some sub-categories of RFN, some significant results were found for each variable. The study has implications for science teacher education to support teachers' understanding of NOS.

The Relationship Between Students' Understanding of Nature of Science and Their Metacognitive Awareness

Dilara Gören, Ebru Kaya

This study which is conducted as a part of a funded project aims to investigate the relationship between middle school students' understanding of the nature of science (NOS) and their metacognitive awareness. Erduran and Dagher's (2014) reconceptualization of the Family Resemblance Approach (FRA) describes science as epistemic-cognitive and social-institutional systems with aims and values of science, scientific practices, methods, and methodological rules of science, and scientific knowledge, social-institutional categories. Kaya and Erduran (2016) coined the term "Reconceptualized Family Resemblance Approach to Nature of Science" or RFN to emphasize the educational aspects of FRA. A total of 701 middle school students from different grade levels (180 5th, 167 6th, 170 7^{th,} and 184 8th grade students) attended this study. Data was collected through RFN Student Questionnaire and Metacognitive Awareness Inventory Form A and Form B. The relationship between variables was investigated for each grade level separately and middle schoolers (6th,7^{th,} and 8th) as a whole with the Pearson r correlation test. Further, the linear regression analysis was proceeded to examine the predictive ability of metacognitive awareness on RFN understanding. The results show that there is a significant positive relationship between RFN understanding and metacognitive awareness for 5th, 6th, 7^{th,} and 8th graders separately. Similarly, a significant positive relationship was found for all middle schoolers as a whole. The results of linear regression analysis show that metacognitive awareness significantly predicted RFN understanding. The findings suggest that the inclusion of metacognitive prompts or strategies to promote students' RFN understanding can be examined in future studies.

Teachers' Attitudes towards Socio-Scientific Issues in Turkey

Gözde Kurt

Socio-Scientific Issues (SSI) have importance for scientific literacy. Also, teachers' attitudes on SSI shape the students' attitudes. Hence, the purpose of the study is to find the attitudes of teachers toward SSI in Turkey by comparing their teaching branch, working institution type, and teaching experience time. In the study, 161 teachers were chosen by the purposive sampling technique. As an instrument, it was used "Attitudes towards Socio-scientific Issues Scale (ATSIS)". Because the study was quantitative research, descriptive and inferential statistics were conducted while analyzing data. While the independent samples t-tests were used for teaching branch and working institution variables, one-way ANOVA was used for the teaching experience time variable. The results of the study showed that the teachers agreed to the sentences in ATSIS's dimensions. Other results depicted that there were statistically significant differences between ATSIS and teaching branch & working institution. Science-related teaching branches showed high scores on ATSIS than non-science branches. Also, the attitudes of teachers who are working in private institutions were found higher than the teachers who are working in public institutions. On the other hand, according to the results, there was no difference between ATSIS and teaching experience time. For further researches, the study might be supported with qualitative research methods by increasing the number of the sample.

Keywords: Socio-Scientific Issues, Attitudes, Teachers

Acknowledgment: This work is conducted under the supervision of Dr. Fatma Aslan-Tutak as a partial requirement of the course of *SCED 570: Research in Science/Mathematics Education*

What Preservice Science Teachers are Telling Us About Simulation-enhanced Inquiry Based Asynchronous Science Lesson?

Ilgım Özergun, Assoc. Prof. Sevil Akaygün

The aim of this study was to explore preservice science teachers' (PSTs) descriptions of simulation-enhanced inquiry-based lesson for asynchronous learning environments before and after attending a professional development module. Throughout the module, Simulation-enhanced Inquiry-based Asynchronous Environment Module (SIMINA), PSTs have experienced different aspects regarding the content of the module, hence some changes may have happened in their descriptions of inquiry-based science education, simulations, and asynchronous learning environments. To explore these changes, ten senior PSTs recruited to participate voluntarily in the study. In this phenomenographic study, data collection tools were pre-interviews, post-interviews, and field notes. The data was analyzed continuously by reading, coding, re-reading, and analyzing the interview transcripts, as a part of the constant comparative method (Glaser & Strauss,1967). Data analysis demonstrated that PSTs descriptions conveyed the following categories: *purpose, tool (resource), process, learning and assessment, aspect, communication,* and *technic* in several different ways. One remarkable preliminary finding of this study was that in the post-descriptions PTSs relied more on their own teaching and learning experiences related to inquiry-based science education, simulation, and asynchronous learning environments, compared to their pre-descriptions. Regarding inquiry-based science education, one considerable change was the increased number of codes related to *research question* and *data* which were the two main components of inquiry. Regarding the simulation, one considerable finding was the revealing of two new categories: *resources* and *aspects* in the post-descriptions. In terms of the asynchronous learning environments, one important change was observed in the *communication* category. In the pre-descriptions, the focus was more on *no interaction* whereas in post-descriptions, their focus was more on *how to interact* with either peers or the teacher. Consequently, this study might introduce some innovative elements to design a science lesson by using inquiry-based science education, simulations, and asynchronous learning environments concepts.

References

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Pre-service Teachers' Motivations and Perceived Costs to Participate in the Near-Peer Mentoring Program

İlkem Özdinç, Dilara Kara, Büşra Karga, Gaye Ceyhan

Studies revealed that stress and academic anxiety levels of university students have increased during the Covid-19 pandemic, where their learning and motivation have been interrupted, and they mostly lacked academic and social support. The need for a support program has arisen especially for the incoming students as they face many transition and adjustment issues in addition to common academic and social challenges with students in upper-grade levels. This study utilizes the expectancy-value theory to investigate the motivations of pre-service teachers to participate in the near-peer mentoring program (NPM) as a mentor and the costs they attach to participating in the program. A qualitative inquiry was carried out with twelve participants who were junior and senior preservice science teachers to provide an in-depth understanding of their mentoring experience. Data sources included semi-structured interviews that were conducted via Zoom in the Spring-2021 semester. The findings revealed that the highest motivation among participants to participate in the program was grouped in the utility category, followed by the category of common problems, where the vast majority of the participants stated the common problems experienced by mentees and mentors as a source of motivation to participate in the NPM program. The findings also indicated that the participants listed lack of time and lack of content as costs for engaging in the NPM program. Given the potential benefits to participants, NPM programs may be designed to provide clear roles, responsibilities, and expectations from mentors and mentees to maximize the effectiveness of the support program.

The Relationship Between Science Teachers' Teaching and Educational Internet Use Self-Efficacy Beliefs in Online Education

İlkem Özdinç

Most of the recent research on self-efficacy is explained by Bandura's social cognitive theory which notes that people make preferences based on their self-knowledge, the way a person perceives himself or herself. It is also indicated that teachers' high self-efficacy belief over science teaching affects their attitudes towards the science profession positively. It is important to disclose the status of teachers' self-efficacy beliefs about internet usage as a dimension of the use of information and communication technologies in learning and tutoring processes and to examine the relationship of these competencies with science teachers' beliefs of teaching self-efficacy. This research was conducted with the aim of investigating the self-efficacy beliefs of science teachers and examining the relationship between teaching self-efficacy beliefs to educational internet uses self-efficacy beliefs and their computer skills in the online education process. The research was carried out with a total of 104 science teachers who graduated from 39 different universities in Turkey. The data was collected within the fall semester of 2020-2021 education year by means of the "Teaching Self-Efficacy Beliefs Scale" and "Educational Internet Use Self-Efficacy Belief Scale". A statistically significant correlation between science teachers' teaching self-efficacy beliefs and educational internet use self-efficacy beliefs was found. The one-way ANOVA results showed that there is no statistically significant relationship between teaching self-efficacy beliefs and computer skills. However, K-Independent test results showed that there is a statistically significant relationship between educational internet use self-efficacy beliefs and computer skills.

"Acknowledgement: This work is conducted under supervision of Dr. Fatma Aslan-Tutak as a partial requirement of the course of SCED 570: Research in Science/Mathematics Education"

Effect of Technology-Based Instruction on Fifth Grade Students' Spatial Ability and Geometry Achievement

Sanem Sarılıcan, Sevil Akaygün

Geometry is considered as a basic skill as the features and the relationships of geometric shapes promote different areas of mathematics such as algebra and measurement (NCTM, 2000). However, students have difficulties in understanding and interpreting geometrical shapes (Battista, 1999; Idris, 2006). In this sense, using technological applications and hands-on activities are recommended to help students better comprehend geometry. Studies have indicated the importance of spatial ability and its positive relevance to geometry (Battista, 1982; Schmidt, 2002). Therefore, spatial ability becomes an integral part of geometry achievement. The aim of this study was to investigate the effects of technology-based instruction designed to teach geometry topics on fifth grade students' spatial ability and geometry achievement. The study was conducted by using a quasi-experimental pretest-posttest design. The participants of this study consisted of 20 fifth grade students from a private middle school in Istanbul. Participants received technology-based instruction for 20 lesson hours. During the technology-based instruction, students used various geometry applications from computers and tablets while learning geometry. In order to evaluate participants' spatial ability, the ROT[1] and DAT:SR[2] were administered. In addition, GAT[3] was used to measure students' geometry achievement which was developed by the researcher, and validated by the experts of mathematics education. The data collected from pretest and posttest were analyzed by nonparametric Wilcoxon Signed Ranked test. The result of the ROT ($z = -3.31$, $p = .01$, $r = .52$) and DAT ($z = -3.86$, $p = .00$, $r = .61$) indicated a statistically significant increase in students' spatial ability and geometry achievement ($z = -3.62$, $p = .00$, $r = .57$) after the treatment. Therefore, it can be said that technology-based instruction improved students' spatial ability and geometry achievement.

[1] Purdue Visualization of Rotations Test
[2] Differential Aptitude Test: Space Relations
[3] Geometry Achievement Test

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