

INTERNATIONAL CONFERENCE ON  
EDUCATION IN  
MATHEMATICS,  
SCIENCE &  
TECHNOLOGY

ABSTRACT BOOK



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## 360 DEGREE FEEDBACK: A HOLISTIC APPROACH TO THE INTERACTION OF SELF, PEER, AND TEACHER ASSESSMENT IN A COLLABORATIVE LEARNING PROCESS

*Abuzer Akgün, Ümit Duruk, Gülden Akdağ Gürsoy, Betül Kiliç*

Given the reason that student-centered formative assessment and related feedbacks are slower to emerge, it is getting more puzzling to understand that feedbacks are not directly constructed through an information transmission process. Rather, constructive and effective feedbacks should be provided with teachers make it easier to teach and ensure effective learning. As already known, teachers are tended to prefer more constructive feedbacks to teach and show their frustration in case they cannot receive adequate feedbacks. In a collaborative learning process, teachers find a way of getting into touch with peers and their mentors, along with receiving feedbacks from multiple sources. In addition, receiving constructive feedbacks helps teachers engage in reflective practice more often. There is a clear gap in the literature on the issue of the relationship between reflective practice and feedback quality. The feedback quality still necessitates to be investigated by means of more integrative and holistic frameworks couple together the feedback and reflective practice in a collaborative manner. The present qualitative study aims at exploring and analysing in-depth the feedbacks received in a collaborative learning process with the help of 360 degree feedback assessment. Initially, preservice science teachers were asked to prepare their groups' draft lesson plan and then, record microteaching videos five times in a row in the course of five weeks. Microteaching videos were recorded by the same preservice teacher in each group. The implementers were asked to write their reflections on reflective diaries to monitor their own progress in reflective practice. Peers were required to give constructive feedbacks and improve their implementers in their own group. In conclusion, it is revealed that feedbacks received in the beginning are far from being constructive and adaptive to 360 degree feedback assessment. However, as they get more familiar with the assessment tool, the implementers improved themselves in reflective practice.

**Keywords:** Reflective Practice, Microteaching, Collaborative Learning Process, 360 Degree Feedback Assessment



## 8TH GRADE STUDENTS' KNOWLEDGE LEVELS ABOUT BASIC SCIENCE CONCEPTS

*Coşkun Deveci, Oylum Çavdar, Yasemin Koç, Seda Okumuş*

The aim of this study is to determine the level of knowledge about the basic science concepts of the 8th grade students prepared to TEOG which Turkish exam system in order to pass from secondary to high school. Survey method was used in this study. The sample of the research consists of 108 8th grade students who are studying in 28 different schools in the city center of Erzurum, continuing to prepare a private high school preparatory course. In order to collect data in the research, Science and Technology Test (STT), which consists of 15 open-ended questions containing the concepts of physics, chemistry and biology lessons which are the subfields of science, was used. For the validity of the test, 3 experts were consulted. The consistency of the scorer was examined for its reliability. It was used percentage and frequency rate of descriptive statistics for analyzing the data. Findings from the research show that students have some misconceptions about basic science concepts and often have memorized knowledge about concepts. According to the finding these results, it can be effective that Turkish exam system directs students to memorizing and science concepts have so abstract thus, students cannot revive these concepts as correctly in their mind.

**Keywords:** Science Education, Concepts, Eight Class Students

## A CONTENT ANALYSIS OF FREE BOARDING AND SCHOLARSHIP EXAMINATION (FBSE) MATHEMATICS ITEMS

*Gülşah Başol, Esra Balgalmış, Mukaddes Inan*

This study is designed to content analyze mathematics items between 2011-2015 in the Free Boarding and Scholarship Examination (FBSE). FBSE is a large scale multiple-choice test, applied by the Ministry of National Education (MoNE) in June of every year in order to select students who are in need at 5th, 6th and 7th grade levels according to their success, to provide financial aid. A total of 368-test items in these exams were classified according to the contents of the MEB curricula of the grade level, the renewed Bloom taxonomy. The results were presented using descriptive statistics. According to the findings, at the fifth and the sixth grade level, the items were mostly on the numbers and operations, at the seventh grade the items were mostly on the operations. The least asked topics were data analysis at the fifth and seventh grade level, algebra at the sixth grade level. According to Bloom's Taxonomy, 62% of the items examined were classified into the "application" phase.

**Keywords:** Content Analysis, Free Boarding And Scholarship Examination, Renewed Bloom Taxonomy,

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## A DESIGN OF EDUCATIONAL COMPUTER GAME

*Ali Ozdemir, Aysegul Alaybeyoglu, Kadriye Filiz Balbal*

Nowadays, computer-assisted games have become a popular activity, especially for young people and children. It is expected that using computer games for educational purposes will make learning fun and amusing for every age of individuals. In this study, an educational computer game is designed especially to help students learn amusingly. The designed game can be used either individually or by teachers in the classroom environment and can easily be adapted to each course and topic. The questions in the game can be easily updated. In the study, questions for mathematics lesson is designed and used.

**Keywords:** Educational Game, Educational Computer Game, Mathematics Game, Game Design

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## A DESIGN OF WEB BASED LEARNING ENVIRONMENT

*Ali Ozdemir, Aysegul Alaybeyoglu, Kadriye Filiz Balbal*

Technological developments have influenced the field of education as every field of life. Learning and teaching methods and techniques change and develop with the new technologies. Researchers are developing new methods and approaches that are compatible with technology to ensure the most effective learning way. Web based learning environments prepared by utilizing the possibilities of internet technology are also one of these approaches. Web-based learning environments that can support traditional methods are expected to have a positive impact on the learning of students. In this study, a web-based learning environment is designed in which the exercises related to the subjects in the 10th grade mathematics curriculum are included. A questionnaire is applied to get the opinions of the 58 students studying in vocational high school.

**Keywords:** Web Based Learning, Web Based Mathematic, Web Design

## A DIGITAL TO ANALOG VOLTAGE CONVERTER EXPERIMENT FOR MICROCONTROLLER COURSE

*Şeyma İnçeli, Mehmet Yüksekaya*

Teaching modules and programming of a microcontroller through experiments is a very efficient method. Microcontroller programming usually also requires practical electronics knowledge. Variable analog voltage outputs are usually not available in common microcontrollers, but this type of signal is required for many applications. This experiment is proposed to teach digital to analog voltage conversion (DAC) using pulse width modulation (PWM) by a microcontroller. In the experimental procedure students should generate the PWM signal, develop digital to analog voltage regulator circuit, design a ripple filter, review the experimental results and answer the questions. Students are expected to observe and interpret the code writing, the digital to analog converter and ripple filter effect. This paper describes, the experimental procedure, the materials and methods used in the experiment and the main theoretical concepts, and determine the evaluation methods for the benefits of the experiment. This experiment will be applied to biomedical engineering undergraduates. Their performances will be evaluated through survey questions and their grades.

**Keywords:** Digital To Analog Conversion, Pulse Width Modulation, Microcontroller, Ripple Filter, Laboratory Experiment



## A MOBILE APPLICATION DESIGN EXTENSION FOR SPECIAL EDUCATION TO TEACH BASIC ARITHMETIC OPERATIONS

*Hüseyin Göksu, Tolgay Karanfiller, Kamil Yurtkan*

Cognitive abilities and improving learning experience are difficult stages for the students who need special education. Besides, they also need behavior and communication experience together with the relationships with their environment. In order to focus on these issues, we proposed a mobile application design to teach the students the basic concepts in our previous studies. In this paper, we propose an extension of the previously proposed mobile application to support teaching of the basic arithmetic operations in mathematics. Students who need special education can learn slower than the other students, therefore, an application that can repeatedly explain the concepts and assist the teacher will be helpful. It is aimed to teach them basic mathematical skills together with the supervision of the teacher. The main objective of the proposed extension is to teach the students while keeping their attention continuous. The novelty of this study is that it targets the basic mathematical teaching in Turkish. Similarly with the previously proposed application, the teaching process will include different images of different objects in different sizes in order to keep the students attention for teaching. The images will direct the student in an iterative process and teach the concepts with small tests. Also, this extension will include an intelligence that the student responses will be recorded and accordingly the suitable images will be selected. The previously proposed mobile application is created on Android Studio, based on java programming language and runs on Android devices. Therefore, the extension will be on the same platform, in the same implementation. Android 4.0 (Ice Cream Sandwich) operating system or one of the further versions should be installed for compatibility.

**Keywords:** Teaching Module, Mobile Application, Computer Assisted Education, Basic Mathematics, Arithmetic, Addition, Subtraction

## A NEW COOPERATIVE LEARNING TECHNIQUE: QUESTION JURY

*Ibrahim Benek, Behiye Bezir Akçay*

The purpose of this study is to develop a new collaborative learning technique and examine the effectiveness of the developed technique. In the study, qualitative research methods were used in the study of action research. The study was conducted in the second half of the 2015-2016 academic year. (12 males, 8 females) who were studying in the 5th grade of a middle school in Van province of Turkey in the first half of the semester. The study lasted a total of 8 weeks, 4 lessons per week, in the science classes "Let's Know the World of the Worlds", "The Essence of Our Lives: Electricity" and "The Mystery of the Earth's Mammoth". This work consists of three phases. In the first step, the result of the literature search is the first draft of the "Question jury" technique. In the second stage, the draft questionnaire form was applied for 5 weeks, and the final questionnaire was finalized in the data obtained during the process. In the third step, the developed question jury technique was applied to the same group for 3 weeks. The data in the study were collected by means of a semi-structured interview form, observation forms, student diaries, video recordings and informed-learning form. In the analysis of the data, content and descriptive analysis methods were used. As a result of these analyzes, "cognitive learning", "affective learning", "evaluation" and "process" themes and various codes were formed under these themes. As a result; That this developed application is appropriate to the principles of cooperative learning and that students find the question jury useful, simple and understandable, that they contribute to learning the concept / concept, that this practice leads them to study and investigate knowledge, Difficulties, helping students to self-assess and contributing to their personal development.

**Keywords:** Question Jury, Cooperative Learning, Action Research



## A QUALITATIVE STUDY ON MIDDLE SCHOOL STUDENTS' LEARNING SCIENCE BY USING ENRICHED OUT-OF-SCHOOL ACTIVITIES

*Şahin İdin, Cemil Aydoğdu*

The aim of this study is to investigate how enriched out-of-school learning activities affect middle school students' perceptions on their science learning. For this purpose, there were prepared some enriched out-of-school activities within the scope of three units: The Systems in Our Body, Force and Motion, Electricity in Our Lives. The activities were provided to carry out at various learning environments such as science centres, science museums, healthcare organisations and funfair visits. Science learning was provided at those mentioned learning environments. The study was conducted with 32 seventh grade students in a middle school, that is located in Ankara during 2014-2015 educational year. In the study, qualitative method was used and in this context, interviews, observations and document analyses techniques were used to collect data of the study. It was seen that enriched out-of-school activities had students' negative perceptions changed towards positive within learning science. There are given some recommendations at the end of the study.

**Keywords:** Enriched, Out-of-school Activities, Science

## A QUALITATIVE STUDY ON THE PERCEPTION OF VIOLENCE OF PRE-SERVICE TEACHER CANDIDATES

*Sinan Erten, Atilla Ayaz Ünsal*

Nowadays, the increasing incidents of violence is attracting everyone's attention. The aim of this study is to investigate pre-service teacher candidates' thoughts and values about violence. In this research, 25 students in science education program were studied. A semi-structured interview, a qualitative research method, was conducted in the study. In the interview, students were asked what the violence was and the possible causes of the violence, the violence they encountered in their environment, the situation of the victims in the society, what to do to prevent them, and the responses of the students were analyzed descriptively. According to the obtained data, That violence is an act that is applied both physically and psychologically, that it is an act that is challenged by those who have difficulty in expressing themselves, and that the vast majority of the students are exposed to violence by a person in their or their surroundings. All of the students think that the only way to prevent violence is education, and the vast majority think that legal regulations must be made to deter violence. In addition, students do not see violence as a way of solving the problem, and that no one deserves violence, that it is an act contrary to fundamental human rights, and they expressed cause of violence against women is gender discrimination within the society. They believe that the violence against women is unacceptable under any circumstances, and violence against women can be prevented with that given education about equality of genders to society. According to the results, individuals aware that violence is a communication problem and everyone in the society is affected by violent acts one way or another. They think the way to prevent violence is education. We advise education about violence should given by government agencies particularly to low-level educated citizens in formal and informal areas.

**Keywords:** Violence, Perception of Violence, Violence In Society, Science Education, Pre-service Teachers



## A QUANTITATIVE ANALYSIS OF TEACHER PERCEPTIONS ON COLLABORATION FOR STEM INTEGRATION

*Gürsu Aşık, Esma Baş, Kübra Türe, İrem Türkmen, M. Sencer Çorlu*

It is widely accepted that professional collaboration and communication among teachers need to be effective for a learning culture to prevail throughout the school. The STEM: Integrated Teaching Framework provides a theoretical underpinning that relates professional learning communities to the notion of community of practice. The main focus of the current study is to develop an analytical measure that would be used to investigate how teachers understand and interpret collaboration with their colleagues during planning, implementation and refinement of their lesson plans and how their level of collaboration is affected by some environmental variables. Sample of the study was middle and high school teachers of mathematics and science (N=39), who participated in a year-long PD program. Data consisted of teachers' reflective writings which are analyzed with the analytical rubric developed for the current study. Preliminary findings are discussed with respect to previous research on teacher collaboration.

**Keywords:** Stem Education, Professional Learning Community, Community Of Practice, Integrated Teaching Framework

## A RESEARCH ON THE ARTICLES PUBLISHED IN KASTAMONU UNIVERSITY EDUCATION JOURNAL

*Lütfi Incikabi, Samet Korkmaz, Perihan Ayanođlu, Feyza Aliustaođlu, Nurcan Tekin*

In this study, the articles published in Kastamonu University Kastamonu Journal of Education (KÜKED) have been analyzed in terms of scientific research process. Study areas, study subjects, research methods, data collection tools, sampling and sample sizes and sample selection methods were investigated for this purpose. This study was conducted by using document analysis method. In this context, 1138 articles published between 1995 and 2015 in KÜKED were analyzed. According to the findings of the research, most articles published in KÜKED were in the areas of educational sciences, science education and social sciences. Moreover, teaching, learning context, cultural, social and gender related situations have been the most studied subjects. The lack of articles in the subjects of non-formal learning, educational technologies, and conceptual learning draws attention. Only 57% of the published studies have been described their methodology and, most of the time, descriptive studies have been preferred in the general sense of the studies. As data collection tools, surveys, documents and scales are more often used, while observations and tests (perception / interest / attitude / ability / personality, etc.) and other tools have been seen to be neglected. Most of the studies were conducted with undergraduate students and teachers. When the sample sizes in the studies are examined, it is determined that the maximum sample size is 31-100. In general terms, only 37% of studies have explained sample selection method. It is noteworthy that simple random sampling method is used more frequently than the others.

**Keywords:** Kastamonu Education Journal, Document Analysis, Education Research



## A REVIEW OF RESEARCH ON THE MISCONCEPTIONS IN MATHEMATICS EDUCATION

*Yasin Ay*

Misconceptions have been determined one of the most important barriers on learning mathematics. In this study, it is aimed to investigate the articles about misconceptions in mathematics and conceptual review method was conducted. Within the scope of the study, 21 articles published between 2004 and 2015 were selected through pre-determined criteria. Findings of the review revealed that the number of studies on mathematical misconceptions has increased in the last 5 years. In addition, most of the studies were conducted with primary, elementary and high school students. In these studies researchers generally used multiple choice or open ended achievement tests. Moreover, most of the studies were conducted for the purpose of determining misconceptions, not eliminating misconceptions. Lastly, some recommendations are provided related to findings of the study.

**Keywords:** Misconceptions, Mathematics, Concept Learning



## A REVIEW OF STUDIES ON TECHNOLOGY SUPPORTED MATHEMATICS INSTRUCTION IN TURKEY

*Yasin Ay*

In this study, it is aimed to find out the effects of technology based instruction on learners' mathematics achievement, attitudes towards mathematics and these technological tools/software, which are investigated in Turkish literature. Within the scope of the study, 27 studies published between 2002 and 2014 were selected through pre-determined criteria. Findings revealed that more than 60% of the studies were conducted in primary and elementary classes, while only few of them were conducted with high-school and undergraduate students. In addition, almost all studies were conducted with a sample size less than 100. Most of the studies investigated the use of technology especially in geometry instruction. Almost all studies compared the effectiveness of technology-based instruction with traditional instruction, while only one study compared two different technology-based instruction. 19 studies demonstrated that academic achievement of the students in experimental group increased more than control groups'. In 7 studies there was no statistical difference between pre and posttest scores of two groups. The results also showed that in 7 studies significant difference was found in favor of treatment group in terms of attitude towards mathematics, but in 4 studies there was no significant difference between experimental and control groups. Lastly, some recommendations are provided related to findings of the study.

**Keywords:** Mathematics, Instruction, Technology Use



## A STUDY ON COURSE EXPECTATION AND SATISFACTION OF AN ENGINEERING DEPARTMENT STUDENTS

*Uğur Özcan, Serhan Kökhan, Ali Aykut Fidancı*

In this study, the expectations on course instructor and application area of the students who are studying in the Department of Industrial Engineering, Gazi University and who took Engineering Economics course were tried to be determined by the method of multiple linear regression. The data were obtained through questionnaires. The purpose of the study is to make improvements on the subjects in the priority correction field using the statistical strategy maps.

**Keywords:** Expectation, Satisfaction, Multiple Linear Regression, Statistical Strategy Maps

## A STUDY ON REPRESENTATIONS PLACED IN THE MIDDLE SCHOOL MATHEMATICS TEXTBOOKS

*Lütfi Incikabi, Abdullah Çağrı Biber, Abdulkadir Tuna, Samet Korkmaz*

In this study, representation types in middle school mathematics textbooks were determined and the transitions between these representations were analyzed in the context of in-class and out-of-class activities. Being qualitative in nature, document analysis method was used to analyze the transitions between representations in middle school mathematics textbooks. In this study, mathematics textbooks were examined according to representation types including verbal, algebraic, model, table, graphic and real life representations. Middle school mathematics textbooks prepared by the MoNE commission and used in the academic year 2015-2016 have been analyzed. During the coding process, two experts had worked independently. A total of 7930 contents determined in the middle school textbooks were coded. The data obtained from the codings and the distribution of the transitions used in these contents were presented using descriptive statistics (percentage and frequency). According to research findings, while textbooks contain algebraic representations at most, they have significant distributions in verbal and model representations. On the other hand, it is noteworthy that the table, graphic and real life representations are included in the textbooks in a very small proportion. Looking at the transitions between representations, it is seen that the relations between representations in both in-class and out-class activities are in significant proportions among algebraic, verbal and model representations. In addition, it has been determined that in the case of both in-class and out-of-class activities, the table, real life and graphic representations are preferred the least in both expression and solution of the questions.

**Keywords:** Multiple Representations, Middle School Mathematics, Mathematics Education.



## A STUDY ON THE RELATIONSHIP BETWEEN VOCATIONAL HIGH SCHOOL STUDENTS' PROBLEM-SOLVING SKILLS AND THEIR ATTITUDES TOWARDS COMPUTER PROGRAMMING

*Oğuz Yılmaz, Ahmet Oğuz Aktürk*

A problem is generally a mental imbalance that is created by a conflict situation in which an individual encounters a barrier while they are trying to reach a goal. People meet numerous problematic situations in their daily lives and to be able to overcome these problems, they normally seek solutions in a simple way by implementing the rules which they learned through their past experiences. However, problem solving involves not only mental skills but also certain attitudes and values. Therefore, the problem solving process is one that requires extensive learning and development of some information and skills. Computer programming skills, too, involve at the bottom line the problem solving processes. The purpose of this study is to investigate the relationship between the problem solving skills of the 10th, 11th and 12th grade students attending vocational high schools and their attitudes towards computer programming. The relational survey model was used as the research method. The working group of the study was determined on a voluntary basis from among students attending 3 different vocational high schools located in a province in central Turkey. "The Problem Solving Inventory", which was composed of 24 items and 3 factors, and "The Scale for Attitude towards Computer Programming", which consisted of 38 items and 4 factors, were used to collect the research data. The research data have now been collected and the students' problem solving skills and their attitudes towards computer programming will be compared and contrasted in terms of various demographic variables and the relationship between their problem solving skills and attitudes towards computer programming will be investigated. Suggestions will be made on the basis of the findings obtained from the study.

**Keywords:** Problem Solving Skills, Attitude Towards Computer Programming, Relational Survey

## A STUDY RELATED TO MIDDLE-SCHOOL STUDENTS' SCIENCE CURIOSITY

*Gülendam Halimoğlu, Fatma Gülay Kirbaşlar*

Curiosity might be defined as the need to know, to see, to experience the unknown and the behavior to reach new information. Curiosity is a sense which exists throughout the lifetime and is the prime initiator of human learning. The experiences acquired with a sense of curiosity become more permanent. Therefore, curious people achieve better and more complete learning. Having a class out of the curiosity of the students will make their learning more interesting and entertaining, as it will make their learning easier. The aim of this study is to evaluate middle-school students' science curiosity according to some variables such as gender, class level, liking science lesson, liking science teacher and liking learning science, learning environments (class/laboratories), person who perform activities in science lessons (student/student group/teacher). In this study, quantitative research method and relational screening model have been used. Students who were selected with random sampling method from public middle schools in Istanbul were participated in this study. A form which consists of two sections have been prepared to carry out this study. In the first part, there is demographical features and in the second part, there is a science curiosity scale developed by Harty and Beall (1984) and adapted to Turkish by Serin (2010). The reliability coefficient of 5 point Likert type scale had been found 0.87. SPSS 20.0 was used to analyze the data. ANOVA, independent sample t-test, and Scheffe was used to examine the data with regard to demographical variables. According to scores gained by using science curiosity scale, there is found no significant differences with regard to gender, class, settings in which science lessons done (class/laboratories), person who have students do activities (student/group/teacher) variables. There is found significant differences with regards to liking science lesson, science teacher, and learning science variables based on scores gained by using science curiosity scale.

**Keywords:** Science Curiosity Scale, Liking Science Lessons, Science Teaching



## A STUDY TOWARDS SCIENCE TEACHERS' TEACHER SELF-EFFICACY LEVELS

*Fatma Gülay Kirbaşlar, Duygu Yavuz, Okan Sibiç*

Teacher self-efficacy beliefs is described as a belief of a teacher about his/her capacity towards effecting students' performance. In other words, it is the belief of a teacher about indicating required behaviors or not in order to carry out teaching successfully. As effecting teachers' general tendencies in educational processes, the perception of teachers towards their personal sufficiency also effects the tendencies towards specific teaching activities. It is important to have high self-efficacy because the basis of being teacher has learning and developing continually. The aim of this study is to evaluate science teachers' teacher self-efficacy beliefs according to some variables such as gender, seniority, bachelor degree, graduate degree, presence of a teacher in a family. In this study, quantitative research method and relational screening model have been used. Middle school science teachers selected using random sampling method from public schools in Istanbul were participants. A form consisting two sections was prepared to apply the research. There are demographical features in the first part and teacher self-efficacy scale which had developed by Tschannen-Moren and Hoy (2001) and adapted to Turkish by Çakıroğlu and Sarıkaya (2005) in the second part. The reliability of the scale consisting 24 items and 3 dimensions was found 0.93. The dimension of the scale was entitled as ensuring student participation, classroom management, and teaching strategies. SPSS 20.0 was used to analyze the data. ANOVA, independent sample t-test, Tamhane and LSD tests was used to examine the data. According to the results received through teacher self-efficacy scale, in total and its dimensions, there is found no significant differences with regards to variables such as gender and bachelor degree. On the other hand, there is found significant differences between between variables such as seniority, graduate degree and presence of a teacher in a family and classroom management and teaching strategies dimension.

**Keywords:** Teacher Self-efficacy, Science Teacher, Science Teaching

## A THEORETICAL STUDY ON MATHEMATICAL LEARNING ACTIVITIES: A CASE OF FUNCTION CONCEPT

*Kemal Özgen*

One of the important elements of student-centered education in mathematics education is activity-based learning. In this sense, activities can be seen as the capstone of the mathematics learning-teaching process. How should the features and structure of effective learning activities be? The activities are designed to be used in the classroom in general is designed for what purpose? What are the types of activities and their classification? Such questions are considered important. In the related literature, it is seen that the types of activities and classifications are considered in terms of different theoretical approaches and frameworks. However, it can be said that the aim, cognitive processes, mathematical competences and skills are the focus points in the frameworks and classifications especially for mathematical activities. This study will focus on the types and classification of activities that are important topics for mathematical learning activities. Because it is important for mathematics teachers to understand the differences between the types of activities and to be able to choose more appropriate activities for their students, especially for teaching purposes. In this respect, the types of activities in this study will be examined in terms of purpose, cognitive processes, mathematical competences and skills. In order to embody mathematical learning activities in these different types, samples for function concept have been shown.

**Keywords:** Function Concept, Mathematics Course, Types Of Activities



## A TRAINING GAME DESIGN FOR HELPING THE CODING LEARNING PROGRAM OF THE COMPUTER DEPARTMENT STUDENTS

*Sakir Tasdemir, Davut Alan*

The game is called all of the fun, entertaining and instructive activities people do to appreciate their leisure time. With the rapid developments in computer technology, games have also become digitized, especially among the applications we have used lately on mobile devices. Beginning of the use of information technology in all areas of our lives and the spread of computer-aided education tools have influenced education-training activities. This ensures that topics are taught more effectively and efficiently. In educational services, it is important to use digital games to facilitate lecturing and attract attention. With digital-based educational computer games, teaching process has become more effective and education more effective. In this study, a computer-aided digital game design was carried out in order to increase the motivation of the students who receive computer education in vocational and technical education-based schools. Digital game has been developed using the Unity platform. The main purpose of the designed educational computer game is to make it easier for the students to teach software development processes and algorithms used in problem solving. In this way, the description and understanding of topics can become easier, fun and enjoyable. The games designed with these goals were played by the students and positive effects were observed in the students. In this study, the effects of educational games prepared by digital game based approach to student achievement were examined.

**Note:** This paper is resulted from the master thesis study of the second author.

**Keywords:** Educational Game, Computer Education, Digital Game

## A TURBIDIMETER DESIGN EXPERIMENT FOR BIOMEDICAL ENGINEERING UNDERGRADUATES

*Dilan Ilke Kurt, Mehmet Yüksekaya*

This article describes a laboratory experiment to teach phototransistor and LED driver circuits and analog to digital conversion using a microcontroller through a turbidimeter design for biomedical engineering undergraduates. Teaching electrical circuits and concepts using a real design helps students to use the theoretical knowledge practically and apply it. This type of real application motivates students. The purpose of this design is to drive an LED by BJT transistor and to get a voltage value related to the absorbed light from the LED by phototransistor and to convert the voltage signal of the absorbed light into digital by using microcontroller. The test of turbidimeter in the experiment is applied by measuring the added soil to water in cuvettes. In this paper, similar experiments are reviewed, the experimental procedures are explained, the methods for evaluation the success of the experiment are determined. As a further work experiment will be applied to biomedical engineering undergraduates and evaluation of their success and motivation will be reviewed.

**Keywords:** Turbidimeter, Transistor, Microcontroller, Laboratory Experiment.



## ADVANTAGES OF USING TECHNOLOGY WITH YOUNG LEARNERS OF ENGLISH

*Ece Sarigül, Banu Uslu*

As it is widely known young learners today are very motivated for using technology that is very important in order to be successful in our age and also which is one of the skills of 21st century. Thus, teachers of English can benefit from their high motivation as well as the positive effect of technology and prepare enjoyable activities for teaching English. There are lots of advantages of using technology in the classroom; such as making learning more fun , preparing students for the future , improving retention rate of students , helping students learn at their own pace , connecting with the students all the time when they are even not in the classroom . Furthermore, students can learn valuable skills and build confidence in success by means of technology. In our age, students are becoming to act like digital natives and becoming increasingly digitally literate .When we talk about the technology, the first things that come to our minds are interactive boards , videos , cameras , computers , video cameras or tape recorders . But , there are lots of things that can be applied when using technology that the teachers of English can use such as preparing animations , presentations , digital stories , digital posters online whiteboards , podcasting and flipped classroom , video tutoring , web quests blogs or using youtube videos for educational aims in the classrooms . One important point is that teachers of English can integrate technology into their lessons and then technology may support their language teaching aims. During the presentation , we will try to show some examples of use of technology for teaching English to young learners in addition to giving information about it.

**Keywords:** Using Technology,young Learner,language Teaching,english

## AN ANALYSIS OF SCIENCE AND ARTS CENTER (BILSEM) EDUCATION PROCESS FOR GIFTED AND TALENTED STUDENTS IN TERMS OF STEM

*Ceylan Şen, Seyit Ahmet Kiray, Z. Sonay Ay*

A curriculum consisting of activities that will compel and meet the needs of gifted and talented students is a requirement (Bangel, Moon & Capobianco, 2010). In this sense, the support activities offered by non-formal institutions should meet students' needs and requirements in terms of content and practice while also encouraging improvement of their skills (Schiever, Maker, 2003). It is obvious that if gifted and talented students receive effective and quality education, they undertake occupations in many areas that contribute to the economy and development of the country (NAGC, 2012). In a changing and developing world, many countries are aware of the fact that innovations are needed in many fields ranging from economy, technology, and science to industry so as to adapt to the conditions of the globalizing world (Carnevale, Melton, & Smith, 2011). While educating individuals that will be employed in these areas, using the STEM method for education is fundamental (CDEF, 2014). To this end, this study seeks to analyze the educational contents that are applied in science and arts centers (BILSEM), which are affiliated to the Republic of Turkey Ministry of National Education General Directorate of Special Education and Guidance Services, and the views of the students receiving special education support in these institutions on BILSEM education within the context of STEM. The study will be carried out with 7th grade gifted and talented students in the fields of science and mathematics and receiving education support from BILSEM located in a province in the Central Anatolian region of Turkey. The study has two stages. Initially, the researchers will evaluate BILSEM education content within the context of STEM. The latter stage aims to reveal the opinions of BILSEM students on education contents and activity practices based on STEM components. Data collection tools are an evaluation form prepared by the researchers to analyze education content prepared by the ministry and semi-structured interview forms to be used for interviewing the students. The data to be obtained will be analyzed via the content analysis method. The study seeks to evaluate the education contents to be conducted by the researchers based on students' views so as to arrive at a conclusive assessment of BILSEM education process in terms of STEM. The study results will be presented following the analysis of the findings.

**Keywords:** Stem, Instructional Practices Of Science-art Center, Gifted And Talented Students



## AN ANALYSIS OF THE INFLUENCE OF INQUIRY BASED MATHEMATICS INSTRUCTION ON STUDENTS' SKILLS: A CASE OF RATIO AND PROPORTION SUBJECT

*Z. Sonay Ay, Ceylan Şen*

Mathematical inquiry is an instruction process involving real-life, open-ended, or semi-structured questions (Colburn, 2000). A problem or problem solution involves a set of ambiguities while students are expected to decide on the solution and arrive at a conclusion. What is emphasized during the process is not students' arriving at the right conclusion but developing the skill of reasoning based on facts. Ilany, Keret and Ben-Chaim (2004) states that integrating real-life problems into activities of ratio and proportion leads students to employ various strategies and develop written and verbal explanations. If students engage in such activities, they have the chance to express their opinions either verbally or in writing (Baron, 2010). Students who encounter problems with multiple ratios and proportions develop various solution strategies while forming a common solution and a way to solve the problem (Shield & Dole, 2008). The main purpose of this study is to reveal the influence of inquiry based teaching strategy on 7th grade students' reasoning and communication skills in terms of the subject of ratio and proportion. The study was conducted with 30 seventh grade students studying in a middle school located in a province of the Central Anatolian region of Turkey during the 2016-2017 academic year. The study was conducted within

the scope of the objectives that were specified for the subject of ratio and proportion, which is one of the subjects in the 7th grade curriculum. Inquiry based activities for all the objectives were prepared to create the course content, and they were implemented. 8 students with different mathematical achievement levels were focused on to observe the intended skills. As the study sought to describe the students' in-class interactions, roles, and mathematical thinking skills, qualitative data collection tools were employed. Course video recordings, interviews with the students and the observer, diaries and documents regarding the lecture period were used as data collection tools. At the end of the data analysis, it was seen that the students suggested different opinions based on their current knowledge and were able to develop their own ways for ratio-proportion problems via their reasoning. It was seen that inquiry based mathematics instruction was useful for students to share and express their opinions and thoughts, use the mathematical language, and communicate.

**Keywords:** Inquiry Based Mathematics Teaching, Ratio And Proportion, Secondary School Students



## AN ECOLOGICAL ANALYSIS OF THE TURKISH MATHEMATICS CURRICULUM CHANGES RELATED TO THE TEACHING OF FUNCTION CONCEPT

*Mustafa Gök, Abdulkadir Erdoğan*

In recent years, sweeping changes to the mathematics curriculums have been carried out in Turkey. With these changes, it is noticed that some of the subjects and concepts were excluded from the curriculum and new approaches were adopted by totally abandoning the approaches used in the teaching of some of them. The subject of functions, which is one of the high school mathematics subjects, is the primary subject affected by the 2013 curriculum changes. With this curriculum, the function teaching approach, which is abstract and based on concept set, was abandoned and a new approach, considered to be more compatible with calculus topics, was adopted. To what degree of this approach is consistent within itself and with other subjects is an important research question. This question necessitates an ecological analysis; in other words, it necessitates determining through which function concept, as it is in the curriculum, is supported and which topics it supports, and necessitates determining the likely deficiencies in supporting-supported chain. Anthropological Theory of Didactic (ATD), developed by Chevallard, submits an appropriate structure to implement such an ecological analysis. Praxeological model, the primary model of ATD, is a quaternary model that explains a mathematical activity with (task), the method to fulfill a task (technique), information that explains and supports the technique (technology), and the information behind the technology (theory). Thanks to this model, the praxeologies supporting the acquisitions of the old and the new curriculum and the likely ecological problems can be determined. The purpose of this study is to analyze changes in the teaching of the functions topic of the high school mathematics curriculum in Turkey within the scope of the ecological analysis model presented by ATD. This study was supported by Anadolu University Scientific Research Projects Commission under the grant no: 1408E364. Document analysis method, a qualitative research method, is used in this study. The mentioned documents are the mathematics curriculums implemented 2005 and 2013 dates in Turkey. Analysis of the curriculums was carried out through examining, in both curriculums, the acquisitions regarding the relevant topics, and examining the praxeologies that are behind these acquisitions. The results of the analyses showed that the ecology of function concept is totally changed. It was determined that function concept in the 2005 mathematics curriculum was supported by the topics such as set, relation and logic, and it was taught independently from other topics or concepts which could cause confusion in teaching of the topics (limit, derivative, integral) that prepare for the calculus. It was determined that function concept in the 2013 mathematics curriculum is supported by the topics such as sets, numbers and equations and it was determined that this situation provides a more effective approach in using the function concept as a tool to support the topics that prepares for the calculus via putting forward the meaning of the relationships among the variables. However, it was determined that the new curriculum also contains some disconnections in terms of the relationships among concepts and class levels.

**Keywords:** Anthropological Theory Of Didactic, Ecological Analysis, Mathematics Curriculum, Functions

## AN EVALUATION OF INSTRUCTIONAL INTEGRATION OF BOTANY, CHEMISTRY AND ART FOR TEACHING ABOUT PLANTS IN VIEW OF STUDENTS' PERSPECTIVES

*Emine Çil*

An instruction integrating biology, chemistry, and art was designed and implemented to teach plants to children aged between 10 and 12 in this study. The purpose of this study is to reveal views of the students who were exposed to teaching of plants via integration of biology, chemistry, and art. The instruction designed was carried out within the context of A Journey to Botanical World 2 numbered 213B510 which was supported by Scientific and Technological Research Council of Turkey (TUBITAK) Nature Education and Science Schools (Doğa Eğitimi ve Bilim Okulları). The educational activities of the project were implemented in June, 2014. 11 biology activities (Introduction to Herbarium, Plant Collecting via Herbarium Techniques, Pressing of Plants, Mounting and Labelling of Plant Species, Memorial Forest, Identification Card, Flora Catalogue, Wetland Plants, Let's Have Plants, A Three-Dimensional View of Plants, and A Botanical Trip), three chemistry activities (Herbal Soap, My Egg is Colourful, and Chemical Analysis), and seven art activities (Endemic Plants, Plant Theft, Marbling Art, An Art Journey, Designing Motifs, Carpet and Rug Weaving, and Show Your Creativity) were carried out during the instruction which lasted nine days. In addition to these activities, documentaries about plants were watched and creative drama activities were performed. A city trip was organized with the intention of introducing natural beauties and cultural significances of Muğla city centre. 37 people participated in the instructional activities. The data of the study were obtained from the participants' journals. Thematic content analysis was used to analyse the qualitative data. The data were coded and sub-themes were generated under each theme. The participants' views about the instruction they were exposed to were categorized into five themes: feelings, learning, awareness, attitude, and commitment to nature. Each theme and sub-themes belonging to these themes were presented in separate tables. Based on the findings of the study, it was concluded that the instructional integration of biology, chemistry, and art for teaching about plants made contributions to the participants' realizing their plant blindness. Moreover, as a result of the instruction, the participants wanted to engage in plant care and they enjoyed spending time with plants. The instruction also promoted participants' awareness about conservation of environment and their attitudes towards science and plants.

**Keywords:** Plant, Integration Of Disciplines, Botany, Chemistry, Art



## AN INTERACTIVE STUDENT EXHIBIT ON CLIMATE CHANGE

*Sevil Akaygun, Emine Adadan*

Climate Change is an important issue towards which awareness needs to be raised. To this end, a 6-week teaching module was developed and implemented during the course of an EU funded project, Project Irresistible ([www.irresistible-project.eu](http://www.irresistible-project.eu)). The "Climate Change Module" developed by Finnish team and adapted by Turkish team. The module consisted of 6 lessons focusing on the cause and effects of Climate Change integrating Responsible Research and Innovation (RRI), which are supported by hands-on activities, inquiry-based science experiments, interactive visualization, and role-playing. In the Spring of 2016, the module was introduced to the participating teachers in a one-day workshop where they implemented all the activities as if students. Then, 14 science teachers and one mathematics teacher who collaborated with a science teacher, from 9 schools implemented the module to their students ranging from Grade 5 to 10. Five science teachers integrated the module in science lessons and 10 teachers implemented it in the science clubs as an extracurricular activity. After completing all 6 lessons of the module, students designed



and developed an exhibit as a part of the module. During the preparation of exhibits, students worked in groups for about 3-4 weeks. Each group first brainstormed to choose a specific subject or phenomenon on Climate Change integrating RRI. Then, they worked on the design of their exhibit, planned how to develop the item, and finally constructed it. The exhibits were presented to public at a Science Center. Totally 113 exhibits were developed by 183 students from 9 schools. Exhibits included 37 interactive games, 15 posters, 45 concrete models, 6 digital exhibits, 5 experiments, 13 questionnaires, 1 booklet and 2 functional products which can be used directly in real life. The exhibits were found to focus on 5 categories: Causes of Climate Change, Effects of Climate Change, Cause-Effect Relation, Suggesting a Solution and Broader Perspective, which implies the combination of at least two of former categories. At the end of the exhibition, students were interviewed to understand the process they experienced. The analysis of the interviews showed that students had learning gains in terms of concepts of climate change and RRI, improvement in process skills in terms of development of interactive exhibit. In addition, students said they came across with some conceptual difficulties such as integration of RRI, or physical difficulties such as finding materials, construction of exhibits, or communication difficulties such as organization within the group along the design and development of their exhibits. The module "Climate Change" can be said to be an effective tool for introducing this cutting-edge science topic integrating Responsible Research and Innovation through inquiry based science education. Designing and developing a science exhibit was a new experience for most of the students. Involving in such an experience contributed to students' content knowledge, RRI knowledge, organization skills, communication skills, science process skills, and problem solving skills.

**Keywords:** Climate Change, Interactive Exhibit, Responsible Research And Innovation



## AN INVESTIGATION OF HIGH SCHOOL STUDENTS' CONJECTURING PROCESSES

*Adem Duru, Resul Göl, Osman Birgin, Cemalettin Yildiz*

In high school mathematics teaching programs conjecturing is expressed as one of the behaviours that must be developed to improve reasoning skills of students and it is also emphasized that conjecturing is one of the stages of problem solving processes. In addition to these, conjecturing is one of the main stages in mathematical thinking. Thus, conjecturing skills of students are investigated in this case study method used study. Data were gathered by 3 non-routine problems and semi-structured interviews. The study was conducted with 9 students studying at a high school in Uşak city centre on 2015-2016 academic years. After the analysis of written answers given to the questions by the students and semi-structured interviews with the students, conjecturing types of students were examined related to their mathematical success levels and tabulated. Research results showed that among 5 types of conjecturing which were defined in their research by Cañadas, Deulofeu, Figueiras, Reid, and Yevdokimov (2007) students used only two types of them; Empirical Induction from a Finite Number of Discrete Cases and Perceptually Based Conjecturing. It was also found that as the difficulty level of the questions increased, the number of students performing Empirical Induction from a Finite Number of Discrete Cases increased too.

**Keywords:** Conjecturing, Mathematical Thinking, Secondary School Mathematics Teaching Program, Secondary Education Students

## AN INVESTIGATION OF MIDDLE SCHOOL MATHEMATICS TEACHERS' MISSION AND VISION EXPRESSIONS REGARDING TEACHING PROFESSION

*Cemalettin Yildiz, Resul Göl, Adem Duru*

Teachers have a great value in the education of students and the quality of the education given by them is becoming more and more important day by day. Missions and visions of teachers related to their professions are significant factors in providing the quality of the education and planning the future. Because in their expressions regarding their missions and visions there are important clues about how teachers provide education and training services. In addition, meanings teachers assign to their professions are valuable in terms of revealing their reasons for being. Therefore, in this study, it is aimed to examine middle school mathematics teachers' mission and vision expressions about the teaching profession. This study, which used the qualitative research approach, was conducted with 173 mathematics teachers working in middle schools. The data were collected using a questionnaire consisting of two open ended questions. The obtained data are presented in tables after analyzing with the help of content analysis. As a result of the research, it was determined that the teachers expressed more mission expressions about self-improvement in the field of teaching profession, make students like mathematics lessons, and being a model for them. In addition, it has become clear that teachers are more likely to express their visions of training students as modern, qualified, inquiring, researching, producing creative solutions, and happy individuals. Depending on the results of the study, teachers should be careful to ensure that their mission and vision for their profession is independent of the individual and consistent with their institution. Finally, studies can be done about how much teachers put their mission and vision expressions into practice in the future.

**Keywords:** Middle School Mathematics Teacher, Teaching Profession, Mission, Vision



## AN INVESTIGATION OF MIDDLE SCHOOL STUDENTS' ROTATION OF TWO DIMENSIONAL GEOMETRIC FIGURES

*Nilüfer Zeybek, Esra Demiray*

Rotation is one of the basic geometric transformations in which middle school students should have experience (NCTM, 2000) and to be able to rotate two dimensional geometric figures is among the objectives of the Mathematics Curriculum of 5th- 8th Grades (MoNE, 2013). In this manner, the purpose of this study is to investigate middle school students' ability to rotate two dimensional geometric figures.

The design of the study is cross-sectional survey. The participants were determined as 236 students in a public middle school in Central Anatolian Region by convenience sampling. Among 236 students, 76 of them are the 5th grade, 70 of them are the 6th grade, 39 of them are the 7th grade, 51 of them are the 8th grade students. To collect data, Card Rotation Test (CRT) of Spatial Ability Test which was developed by Ekstrom, French, & Harman (1976) and translated by Delialioğlu (1999) was administered. In data analysis, one-way ANOVA was conducted. According to the results of the study, there was a statistically significant difference at the  $p < .05$  level in CRT scores of four grade levels:  $F(3, 232) = 3.59, p = .014$ . Post-hoc comparisons using the Tukey HSD test indicated that the mean scores for the 5th grade ( $M = 101.51, SD = 3.49$ ) was significantly different from the 8th grade ( $M = 117.12, SD = 4.36$ ). The 6th grade and the 7th grade did not differ significantly from either the 5th grade or the 8th grade.

**Keywords:** Rotation, Middle School Students

## AN INVESTIGATION OF THE RELATIONSHIP BETWEEN VISUAL MATHEMATICS LITERACY SELF-EFFICACY PERCEPTIONS AND METACOGNITIVE READING COMPREHENSION AWARENESS

*Zeki Aksu, Selcen Çalik Uzun, Sedef Çelik*

The purpose of the study is to investigate the relationships between visual mathematics literacy self-efficacy perceptions (VMLSP) and metacognitive reading comprehension awareness (MRCA). The research was conducted with 7th grade students who are enrolled in secondary schools where a city is located in the Eastern Black Sea Region during the 2016-2017 academic year. The present study was done with a total of 301 students. The VMLSP scale, developed by Duran (2011) was used as a data collection tool in this study. And MRCA scale, which was developed by Gelen (2003) and Çakıroğlu (2007) extracted some items from this scale and then performed its validity and reliability. The research was conducted according to the relational model as a quantitative research methods. SPSS 19.0 program was used for analysing the data. Simple correlation analysis and simple linear regression analysis were used in the analysis of the data. For this study, Cronbach's alpha reliability coefficients of visual mathematics literacy self-efficacy perceptions (VMLSP) and metacognitive reading comprehension awareness scales were 0.94 and 0.77 respectively. As a result of the study, it was found that there is a moderate correlation ( $r = 0.51$ ) in the positive direction between the above mentioned structures. Independent sample t test was used as an analysis method in order to determine whether there is a difference according to the sex in terms of the variables of interest. Discussions of research findings in the current study were given in more detail.

**Keywords:** Visual Mathematics; Metacognitive; Scale.



## AN OVERVIEW OF POSTGRADUATE THESES WITHIN THE FIELD OF SCIENCE AT EARLY CHILDHOOD EDUCATION IN TURKEY

*Özlem Okyay, Ceren Mutluer*

In this study, thematic distributions of postgraduate theses concerning science at early childhood education in Turkey were reviewed. The universe of this research was comprised of 442 postgraduate theses all of which were approved and archived with the keywords namely as 'education' and 'teaching' between 2007 and 2017 by the Council of Higher Education, Directorate of Publication and Documentation. The sample of the study included a total number of 34 theses (22 master's theses and 12 dissertations) within the field of science at early childhood education. Mixed pattern in 7 studies, quantitative research in 20 studies and qualitative research method in 7 studies was used. 16 studies carry experimental features. It has been determined to be relevant with science process skills of 15 studies and attitudes towards science of 9 studies. Only 3 studies related to influence of science on developmental areas and two studies related to integration with different activity areas were encountered. It is seen that the master thesis concentrate on the attitudes towards science education of preschool teachers, the use of science process skills and the acquisition of science concepts in early childhood. In the doctoral dissertations, it was questioned that the effectiveness of the training programs (research / inquiry-based, constructivist approach, brain-based, sense-based, story-based) developed by the researchers and four scales towards scientific process skills were developed. At the end of the study, it was suggested that to increase of studies on the effect of science education on different development areas and related to integrate with content areas

**Keywords:** Early Childhood Education, Science Education, Master's Theses And Dissertations.

## ANALYSIS OF ARGUMENTATION DEVELOPMENT IN LABORATORY APPLICATIONS BASED ON THE ARGUMENTATION BASED SCIENCE INQUIRY APPROACH

*Tufan Inaltekin, Hakan Akcay*

The purpose of this study is to examine effect development of argumentation components students of test reports writing argumentation based in lab applications in which is a inseparable part one of science education. The research is to occur of 46 students, which are received education in science teacher class of a state university in Turkey on 2015-2016 autumn session. The Research experimental design, is to established as time-series pattern which how of condition of sample group produce be change to depending times. This research data is to collected during five week general biology lab. Research group to have prepare experiment report using for argumentation based science inquiry approach throughout application. it is to give points with rubric the experiment reports which be typed argumentation based of students and after it is to analysed with SPSS 17. Program. According to analyse conclusions, it is to seen meaningful increase points of each component in argumentation based test reports prepared of research group during process. Research result demonstrate that students is significant to reflect efficient learning to be used of argumentation based science inquiry approach in lab application.

**Keywords:** Argumentation, Laboratory, Argumentation Based Science Laboratory, Teacher Education



## ANALYSIS OF IN-SERVICE TRAINING NEEDS IN TEACHING TECHNOLOGIES OF SOCIAL SCIENCES TEACHERS

*Özkan Akman*

The purpose of this study is to determine the subjects that social sciences teachers in secondary schools need in technology use in education and aim to be dealt with in-service training activities. The research was conducted using interview techniques from qualitative research methods. In this context, 22 social studies teachers working in Gaziantep were consulted. Semi-structured interview form has been applied to the study group to identify the subjects of in-service training needed in social studies teachers' teaching technology field. The findings obtained from the interview form were coded and tabularized. Based on the findings, the subjects social sciences teachers need are effective utilization of teaching materials, effective use of interactive board, the existence of utility programs, the use of technology in education, and the use of educational technology. According to the results obtained from the interviews, it is seen that some of the teachers did not obtain the desired efficiency despite participating in in-service training activities. It may be emphasized that it is significant that the experts who are assigned as trainers in the in-service training activities are carefully chosen and that the needs analysis of social sciences teachers is carried out effectively before these activities are started. However, it is thought to be useful in the separation of branches of in-service training activities.

**Keywords:** Social Studies Education, Technology Use, In-service Training

## APPLICATION INNOVATIVE AND EDUCATIONAL TECHNOLOGIES IN HIGH EDUCATION

*Sholpan Sakipova*

The article deals with the problems and peculiarities of physics teaching in agricultural universities when credit technology of education. The article discusses problems and peculiarities of teaching physics in the agricultural universities in credit technology of training. Due to the increasing skill requirements in the current market conditions and the need for training of competitive specialists of agricultural profile, at the same time with the shortage of contact time with the credit technology of education arose the need for new approaches in teaching fundamental disciplines such as physics, mathematics etc. This is possible with new innovative approaches to methodological support and strengthening of a role of independent work of students.

**Keywords:** Competitive Specialist, Professional Competence Of A Specialist, Credit Education Technology , The Role Of Independent Work Of Students, Innovative Didactic System, Universal Didactic «case», Tutorial Organizer, A Set Of Practice-oriented Textbooks, Flex



## ARAB LEARNERS' CULTURAL VALUES AND THEIR INTERFERENCE WITH E-LEARNING

*Khalid Rabayah*

Growing number of studies have demonstrated that adoption of technological solutions such as e-learning is a complex process where social, cultural, and contextual factors are playing mounting role in the process. Using Internet as a learning platform is prevailing over other traditional means, especially at university level. Yet little is known about the interaction of cultural and social elements of developing countries in general and Arabic countries in particular in that regards. This study comes to satisfy this gap.

A Quantitative approach, supplemented with a qualitative analysis, were adopted in the study. To understand the true interrelation among the e-learning adoption and the cultural norms, the attitude of 354 students from three Palestinian universities were analyzed, firstly via a questionnaire, and then via intensive focus group discussions with some selected samples of students. The collected data were analyzed via SPSS. The research investigated the impact of several cultural dimensions on the effectiveness of electronic learning among the Palestinian University students. Among those cultural dimensions that were considered are: collectivism, power distance, human and personal orientation, uncertainty avoidance, time orientation, and verbal vs. textual communications. The results of the study clearly indicated a strong correlation between effectiveness of E-learning as a channel of education and culture. It has been undoubtedly proven that effectiveness of e-learning is hindered by domestic cultural issues, as most of the technical solutions in that domain were designed to fit with the western society cultural rather than the Arabic culture per se. This analysis presents concrete guidance for global firms in the domain of electronic learning and training to understand the role of the diverse cultural scope on e-learning. The guiding strategies stemmed out of this report can be applied in other Arabian countries, as they more or less have similar cultural norms and practices.

**Keywords:** E-learning, Distance Learning, Cultural Norms, Arabic Culture

## ASSESSMENT OF MATHEMATICS TEXTBOOKS' QUESTIONS ACCORDING TO THE COGNITIVE PROCESS LEVELS OF BLOOM'S REVISED TAXONOMY

*Ümit Kul, Zeki Aksu*

The present study aims to analyse and evaluate the contents of 6, 7 and 8 grade Turkish mathematics textbooks in terms of Bloom's cognitive process dimension as well as the question types. Textbooks from private publishers were assigned as course books to be used in state schools for the following five years being valid from five year by MONE is examined. Sections regarding the measurement and evaluation within the unit and at the end of unit are considered while analysing the mathematics questions. 1187 mathematics questions are examined according to the cognitive process domain of the taxonomy. The classifications of the lower-order and higher-order cognitive abilities were formalized on the basis of earlier research. The general findings illustrated that mathematics questions coincides with remember (11%), understand (27%), apply (44%), analyze (17%) and evaluate (1%). The results obtained from the preliminary analysis of textbook showed that majority of the mathematics questions (82%) call for higher-order cognitive skills. In addition, open-ended questions and multiple choice test type are frequently preferred in mathematics textbook.

**Keywords:** Mathematics Textbook; Bloom Taxonomy; Measurement And Evaluation



## ASSESSMENT OF SKILL-BASED QUESTIONS PREPARED IN THE SCOPE OF FIFTH GRADE SCIENCE APPLICATIONS COURSE ACCORDING TO PISA PROFICIENCY LEVELS

*Zeynep Öztürk, Ersin Karademir*

Science education has great importance in preparing students for real life. One of the objectives of the science curriculum is to improve the knowledge and skills that will help students to understand the environment they live in and the interactions that occur in the process. This is possible by raising science literate individuals. Science literate individuals are individuals who can look at the events around them with a scientist's viewpoint. The Science Applications course, which is a course aiming to make students aware of this situation and to make sure that the concepts and terms learned in science courses can be observed in the concrete, was added to the curriculum as an elective course in the 2013-2014 academic year by the Ministry of National Education. In recent years, some studies have been carried out in order to enable countries to observe the success of their students on the international level. One of these is the Programme for International Student Assessment (PISA), conducted by the Organization for Economic Co-operation and Development (OECD) once in three years, evaluating the skills gained by students in the age group of 15. In the context of this program, the aim is to measure students' mathematical literacy, science literacy and reading skills. Purpose of the research is to evaluate the skill-focused questions prepared by the researchers aimed to evaluate the skill-based activities of the fifth grade science applications course, according to the levels in PISA Science Literacy competency scale. Document review technique, one of the qualitative data collection methods, is used in the study. This technique involves analyzing written materials which are considered to include information about the phenomena we plan to investigate. In this study, skill-based questions prepared by the researchers are used as data source. Documents to be used as data sources are determined according to the purpose of the research. A sample of 21 skill-based assessment questions prepared by researchers for the 2016-2017 academic year were classified according to the PISA science literacy levels. In order to make the classification easier to understand, considering Bloom's Cognitive Taxonomy, 1st and 2nd levels of PISA are classified in the knowledge and comprehension step; 3rd and 4th levels of PISA are classified in application and analysis step; 5th and 6th levels of PISA are classified in the evaluation and creation step. Expert opinion is obtained through this classification (2 experts in science education, 2 science teachers, 1 Turkish language expert). A

comprehensive content analysis is conducted to the data in the documents. PISA science literacy levels and comparative data are analyzed. The results found after this phase are digitized and shown on the table. We found that among the sample assessment questions prepared by the researchers, one question is in the first level, eight questions are in the second level and 12 questions are in the third level of PISA. We observed that high level skills containing levels 4, 5 and 6 of PISA were not present in these questions. Considering the findings we observe that the questions prepared by the researchers overlap with the questions in the PISA evaluation program. In particular, 57% of the questions corresponded to level 3, indicating that this questions are able to develop students' daily life skills such as critical thinking, problem solving and decision making.

**Keywords:** Science Applications, Skill, Pisa, Proficiency, Assessment



## ATTITUDES OF PRIMARY SCHOOL TEACHERS TOWARDS USE OF TECHNOLOGY IN EDUCATION

*Jale Kalemkuş, Fatih Kalemkuş*

The purpose of this study is to investigate whether there is a significant difference in attitudes of primary school teachers towards the use of technology in education based on gender, work duration, and training for technology use in education. The study was conducted using survey model. The sample of the research is consisted of 76 primary school teachers. The research data was obtained by using "Technology Attitude Scale" developed by Yavuz (2005) with a reliability coefficient of 0.8668. The scale consists of 19 items (6 negative, 13 positive statements). The scale composed of factors such as "Not Using Technological Tools in Education", "Using Technological Tools in Education", "The Effects of Technology in Education", "Teaching How to Use Technological Tools" and "Evaluating Technological Tools". Frequencies, percentage, mean, standard deviation, independent t-test and one-way analysis of variance (ANOVA) were used for statistical analyses. As a result of the analysis, it was determined that the primary school teachers' attitudes towards technology use in education did not differ significantly according to gender and training for technology use in education variables. However, when the data are analyzed in terms of work duration, it is found that there is a significant difference between the teachers who have 1 to 5 years of service and the teachers who have 10 or more years of service in favor of the teachers with 1-5 years of service.

**Keywords:** Primary School Teacher, Technology, Attitude



## BEYOND CLASSROOM BOUNDARIES, ENHANCING MARGINALIZED CHILDREN'S SELF-CONCEPT THROUGH LEARNING OUTSIDE CLASSROOM APPROACH

*Cindy Wong Chyee-chen, Kamisah Osman*

Workplace expectations and scenarios in this 21st century require human capitals who are equipped with competencies to embark in the STEM related careers. Therefore, marginalized children need to be prepared and upgrade themselves. Analytical scrutiny of marginalized children talent development often found low self-concept as the most important factor which inhibit their learning development. It is argued that effort to enhance self-concept among marginalized learners must be revolved around their surroundings. Conductive and meaningful learning environment need to be crafty designed to suit their needs and tendencies. In this study, self-concept covers evaluative appraisal of oneself in both the academic and non-academic aspects. This study is aimed to determine the effect of Learning Outside the

Classroom (LOC) primary science module towards enhancing self-concept among marginalized learners' in Malaysia. By employing a quasi-experimental with pre-test post-test, nonequivalent control group research design, a total of some 73 primary school marginalized learners were involved in the study. The treatment group used LOC primary science module while the control group experienced learning using conventional module prepared by the Ministry of Education. In the treatment group, teaching and learning processes occurred outside the classroom using particularly flora and fauna within their surroundings. Self-concept was evaluated using Self Descriptive Questionnaire (SDQ). Data obtained were analyzed using MANOVA repeated measures. Analysis of findings lead to inference that there was a significant main effect of group in shaping the children's self-concept. This study concludes that LOC modules, which carry in itself meaningful and fun science learning experiences has successfully developed marginalized children self-concept. It is then suggested that similar learning modules as developed in this study, be developed across other themes as envisaged in the science primary curriculum for marginalized children.

**Keywords:** Learning Outside Classroom, Marginalized Children, Primary Science, Self-concept, Module



**BOTH LASTING AND TRANSLATED NATURE OF SCIENCE UNDERSTANDINGS. IS IT REALLY POSSIBLE? A COLLABORATIVE INTERVENTION BY MEANS OF INSTRUCTIONAL PLANNING WITHIN HIGHLY-CONTEXTUALIZED EXPLICIT-REFLECTIVE NATURE OF SCIENCE INSTRUCTION**

*Ümit Duruk, Abuzer Akgün, Betül Kiliç*

It is most likely that students' nature of science understandings are mediated by their teachers' practices and classroom settings. Research results have consistently shown that science teachers cannot easily translate their nature of science understandings into practice. Consequently, teachers should be provided with supportive scaffolds to enhance both their nature of science understandings and improve their translation of nature of science understandings. The purpose of the present study is twofold; a) to improve preservice science teachers' nature of science understandings coupled with philosophy of science embedded explicit-reflective nature of science instruction, and b) to make preservice science teachers engaged in lesson planning in a developmental process. The intervention was undertaken within the nature and history of science course. In the course, preservice science teachers were given a task encompassing the inclusion of explicit-reflective nature of science instruction into science content. On the other hand, they were also asked to integrate the science content into their lesson plans. They were all worked in groups while practicing on their lesson plans. Data were collected by VNOS-C, lesson plans, semi-structured interviews and focus group interviews. The initial findings revealed substantial improvements in preservice science teachers' nature of science understandings. However, it appeared that they had difficulty in preparing lesson plans in relation to nature of science tenets. They tend to get unsettled about how to translate their nature of science understandings into lesson plans.

**Keywords:** Nature Of Science, Instructional Planning, Contextualized Nature Of Science Instruction



## CLASSIFICATION OF SECONDARY SCHOOL STUDENTS IN TERMS OF THEIR LEVELS OF HAVING PISA MATHEMATICAL COMPETENCIES THROUGH COGNITIVE DIAGNOSTIC MODELS: A LONGITUDINAL REAL DATA STUDY

*Tahsin Oğuz Başokçu, Arzu Canpolat, Erhan Arda*

The purpose of the study is to carry out analysis of the measurements related to mathematical competencies of the students within the scope of PISA test by using CDM models and obtain findings related to longitudinal developments of the competencies in question. The study was carried out within the scope of TUBITAK Project, numbered 115K531. Cognitive Diagnostic Models are those which are used to determine the abilities of the individuals who take the test categorically and see whether they have the necessary characteristics in order to answer the items correctly. The most important aspect of these models is that they enable an item to be associated to more than one attribute. This means that it is possible to ignore the hypothesis of mono-dimensionality of the item in general testing strategies. In addition, it also enables us to identify more than one attribute so as to answer the item correctly and to carry out statistical analysis accordingly. In CDM, item-attribute relation is defined by using Q matrix where the relation of each item to the attributes is determined. In the study, 4 basic competencies among the mathematical competencies of PISA framework were determined as attributes. These competencies can be defined as follows: 1. Communication refers to abilities such as interpreting the meaning of mathematical concepts, relating mathematics to oneself, other disciplines and daily life, expressing and understanding a given mathematical content orally and in written form; 2. Mathematizing refers to modeling and formulating daily life problems and expressing them in a mathematical form; 3. Reasoning and argument / Devising strategies for solving problems consists of describing the elements of the problem, selecting and designing appropriate strategies to solve the problem, showing the mathematical solutions to the problem and providing evidence; and 4. Using symbolic formal and technical language and operations includes processes such as being able to make sense of, interpret and solve the expressions containing symbols and formula. The tests used in the study were selected among the item pool created as a result of item writing training for upper level thinking abilities. To which mathematical competencies the items are related was determined by experts. The equivalence of the selected items to those used in PISA were proved with statistical analysis within the scope of the Project. The implementation was carried out 3 times with 2-month intervals, with 3200 6th grade students selected among 448 secondary schools in Izmir province by using stratified two-stage cluster random sampling design. The findings were obtained by DINA, G-DINA and Fusion Models, which are all among the models of CDM. The analysis results revealed that the predictions among the levels of having mathematical competencies of the three models were close to each other. Moreover, it was observed that the level of the class with students having all characteristics (full class-mastering all attributes) was 8%, whereas the level of the one with having none (null class) was 12% according to the average of classification probabilities.

**Keywords:** Cdm, Pisa, Mathematical Competencies



## COMPARISON OF REAL VS. ONLINE SOCIAL FRIENDSHIP NETWORKS OF VOCATIONAL SCHOOL STUDENTS

*Ilker Türker, Mustafa Aksin*

In this century of communication, humans make friendship interactions both in real-life and online social networks. Moreover, we can say that online friendship patterns, compliance with a portion of the real-life connections, promote irregular connections those are not affined with real-life acquaintances. This reality mostly originates from the high computerization of the society, with an additional boost-up defined by the usage of mobile smartphones. An issue not clearly set forth is that, in what ratio these two distinct

friendship networks overlap. We investigated this issue by constructing both real-life and online friendship networks of Safranbolu Vocational School students. The data is collected by applying a survey to 259 students of the computer technologies program. The network analysis indicates that the real friendship network between the students are have higher average degree, density, together with less average path length compared to the online friendship network. Both networks display small-world and scale-free properties together with similar high clustering, modularity and diameter measures. We conclude that online friendship network covers approximately half of the real-world links, indicating that individuals do prefer being friends online in a ratio of ~50%, compared to their classroom friendship.

**Keywords:** Social Networks, Complex Networks, Small-world Networks



## COMPARISON OF STUDENTS' LEARNING AND ATTITUDE IN TECHNOLOGY SUPPORTED AND LABORATORY BASED ENVIRONMENTS

*Feral Ogan Bekirođlu, Onur Oymak*

This research study aimed to compare students' conceptual knowledge and attitudes towards physics lesson who were separately taught with three different methods. The main research question was as follows: Are there significance differences among technology supported teaching, laboratory-based teaching, and curriculum-based teaching in terms of students' learning and attitudes. Experimental design was carried out for this research. The participants of this study were 144 9th grade students studying in an all-boys state high school. The students who were in the technology supported classroom constituted the first experimental group while the students in the laboratory based classroom comprised the second experimental group. There was also one control group whose students were taught based on the curriculum. Each group had 48 students. The teacher of three groups was the same. Data were collected in the physics lessons. Both quantitative and qualitative research methods were used to gather data. The students' conceptual learning was assessed with the help of "Force and Motion Achievement Test". This test was applied before and after the treatment with an eight-week time difference. Cronbach Alpha value for this application was found as .67. Worksheets were also designed to follow students' learning during the instruction. The worksheets were evaluated by rubrics created by the researchers. In order to determine any change in the students' attitudes towards physics lesson, "Physics Lesson Attitude Scale" was used. This scale had high internal consistency with .93 reliability value. Findings showed significant differences between the experimental groups and control group. In other words, when technology or laboratory approach was embedded in the instruction, the students became better learners and their attitudes increased. Results also presented no significant differences between the experimental groups. However, analysis of the worksheets revealed that using technology in the class facilitated learning during the instruction more than using laboratory experiments.

**Keywords:** Technology, Laboratory, Learning, Attitude

## COMPARISON OF STUDY SHEET PREPARATION STATUSES OF PROSPECTIVE BIOLOGY AND MATHEMATICS TEACHERS

*M. Handan Gunes, Rezan Yilmaz*

Recently, different instructional materials have been in the spotlight in order to achieve the targeted success in the process of education. Within that context, new instructional materials are being developed to attract the attention of students as well as to promote them to establish a cause-effect relationship and to think in a miscellaneous manner. One of these materials is study sheets, which can be used for detecting pre-knowledge about the subject tackled and teaching the subject in a meaningful and permanent way as well as for the process of evaluation. In the recent years, study sheets, which can be utilized at various stages of modern education process, are preferred since they are easy to use, can be modified according to the content, and break the monotonous cycle of the course. The study has been carried out with 30 prospective biology teachers and 25 prospective mathematics teachers studying at the faculty of education of a state university. This study aims at revealing study sheet creating statuses of prospective mathematics and biology teachers and make a comparison between the departments. For that purpose, the prospective teachers were asked to firstly pick an acquisition from the related curriculum and to prepare a study sheet by taking criteria such as clarity, visual quality, and content that are compatible with their selected acquisition into account while preparing their study sheet. The study sheets prepared were evaluated according to these criteria both by themselves and by the researcher. These evaluations are considered as data. The collected data were analyzed by comparing the evaluation of the researcher and the self-evaluation of the participants. The obtained results indicate that the evaluations by the prospective biology teachers are mostly similar to the evaluations by the researcher, whereas; the evaluations by the prospective mathematics teachers are partially similar to those by the researcher. However, when it comes to criteria related to motivation and ensuring association, the evaluations by prospective teachers from both departments display differences with the evaluations by the researcher. Furthermore, in terms of some of the criteria, both prospective mathematics teachers and prospective biology teachers obtained results that are similar to those of the researcher.

**Keywords:** Prospective Teacher, Study Sheet, Instructional Material



## CONCEPTUALISATION OF PHYSICS CONSTRUCTS IN HEALTH SCIENCE PEDAGOGY: A CASE STUDY OF MEDICAL IMAGING STUDENTS' UNDERSTANDING OF FORCES AND MOTION

*Mark Marais*

An important topic in classical physics taught in any first level or introductory physics course, is dynamics, the study of forces and motion and the laws which govern motion, namely; Newton's laws of motion. Traditionally, first year radiography students, in the medical imaging programme at a university in South Africa, had generally struggled to understand motion within the disciplined-based framework of physics. Research suggests that students bring their own understanding of the physical world, based on everyday experiences, including ideas about how objects move, into the classroom. These alternative conceptions or misconceptions are very resistant to change and may hamper teaching and learning. Forces and motion are fundamental conceptual themes throughout physics, and a flawed understanding regarding these may hinder learning in other areas of the subject as well. This study investigates, through a process of coding concepts related to an understanding of how objects move, and using concepts of Legitimation Code Theory (LCT) - a flexible and developing tool for analysing a variety of educational environments, students' conceptual understanding of force, and the motion of objects, both prior to and after receiving instruction (the pedagogic intervention). It is possible to identify a two-fold challenge related to the teaching and learning of Newton's laws of motion that will serve as the point of departure for this investigation. One problem area pertains to how students can achieve the shift from everyday misconceptions to the

discipline-based physics conceptions required for an understanding of motion. The other involves features of instruction, including concomitant resources, such as; notes, tutorials and online resources that can facilitate this shift. The participants in the study consisted of first-year radiography students at the Cape Peninsula University of Technology (CPUT), in the Western Cape Province of South Africa, doing a full-year introductory physics course as part of their studies.

**Keywords:** Physics, Pedagogy, Dynamics, Forces, Motion



## CONNECTING CLASSROOM DISCOURSE TO STUDENTS SCIENCE LEARNING IN A REFORM-BASED CURRICULUM UNIT

*Murat Akarsu, Maurina Aranda, Richard Lie, Selcen Guzey, Tamara Moore*

Recent science education reforms highlight the importance for teachers to implement effective instructional practices that promote student learning of science and engineering content and their practices. Effective classroom discourse has been shown to support the learning of science, but work is needed to examine teachers' enactment of reform-based curricula by focusing on the content, complexity, structure, and orchestration of classroom discussions. In the present study, we explored teacher-student talk with respect to science in a middle school t focused on genetics and genetic engineering. The following research questions guided our study: 1) What are the similarities and differences in classroom discourse that occurred within a reform-based curriculum unit enacted by three teachers? 2) How do the differences lead to variations in student science learning? Through qualitative and quantitative approaches, we found that there were clear differences in three teachers' use of questioning strategies and presentation of new knowledge that affected the level of student involvement in classroom discourse and the richness and details of student contributions to the conversations. We also found that the verbal explanations of science content differed amongst the three teachers through their use of analogies, depth of science content and their ability to connect physical and conceptual models. An analysis of variance model showed significant differences between each class, which suggests explanation depth and dialogic discourse contribute to higher post-test scores. Collectively, the findings in this study demonstrate that while teachers designed reform-based curriculum units and committed to consistently teach the curriculum materials, their use of different dialogic strategies, discussion patterns, and interactions with students differed and thus impacted student learning.

**Keywords:** Student Learning, Classroom Discourse, Role Of Teacher



## COUNTING ERRORS MADE BY PRESCHOOL CHILDREN IN RATIONAL COUNTING

*Sonnur Işitan, Mesut Saçkes, Kerem Avci*

This study aimed to examine the errors children make during the acquisition of counting skills. The sample of the study included 36-66 months old children, 23 girls and 26 boys with a total of 49, attending an official kindergarten in the center of Balıkesir. An interview protocol that included six questions was used to identify errors children make during counting tangible objects. The interviews were conducted individually in a quiet place with children and lasted about 5 to 10 minutes. The results demonstrated that girls made fewer counting errors than boys. Likewise, older children made fewer counting errors than their younger peers.

**Keywords:** Early Childhood, Counting Errors, Rational Counting

## DESIGN OF E-MATERIAL INCLUDING QR CODE APPLICATIONS FOR BIOLOGY EDUCATION

*Kübra Kösal, Gülcan Çetin*

: The purpose of the study was to design an e-material including QR code applications for biology education. In this study ADDIE model (analyze, design, development, implementation, evaluation) was used. Plant Anatomy Laboratory Manual including QR code applications for the students studied in Biology Education in Education Faculty was designed. Firstly, Plant Anatomy Laboratory Manual for third grade students studied in Biology Education was examined. After semi-structured interviews were conducted with the students and instructors about the manual, some changes were made to the relevant pages of manual. The manual was enriched by adding various photos taken and videos recorded. Here a sample activity sheet was presented from the manual.

**Keywords:** Qr Code Applications, Augmented Reality, Plant Anatomy Laboratory Course, Plant Anatomy Laboratory Manual, Biology Education



## DESIGNATION AND IMPLEMENTATION OF AN EFFICIENT BOTANIC GARDEN VISIT IN ORDER TO RAISE PLANT AWARENESS AND ATTITUDE TOWARDS PLANTS

*Funda Gül Iri Karadeniz, Emine Çil*

Plants are basis of the nature. Plant blindness is defined as that people do not notice plants around their own environment, comprehend the importance of the plants for environment and humans, appreciate aesthetic and unique features of the plants and they incline to downgrade the plants below animals according to their criterion of importance. People's attitude towards the plants comprises the compound of their considerations about plants, their sensations and behaviour related to the plants. How the plants are taught is very crucial in alleviating plant blindness and supporting positive attitude towards plants. Teaching in out-of-school environment has recently become one of the most focused educational programs about plants. In this study, a botanic garden visit for sixth grade students was designed and implemented in order to raise their awareness about plants and to support their positive attitudes towards plants. This educational programme comprises of three stages: pre-visit, intra-visit, post-visit. Pre-visit activities were designed to give information about place that will be visited, ensure that students are familiar with school curriculum, prepare students for visit and specify rules and schedule of the visit. In designing intra-visit activities, student-oriented education strategies were used. During the visit, first, study pages were completed. After that, art activities of poster, collage and mask were implemented. In post-visit stage, three activities, namely "my feelings and considerations", cloverleaf and acrostic were performed. Designed educational programme was presented to a group of three experts in order to get their opinion. In 2014-2015 academic year, a pilot practice of the programme was completed in a secondary school, in Yatağan, Muğla. A total of 32 students was attended to the pilot practice. Main implementation of the programme was completed in 2015-2016 academic year, in Germencik, Aydın with the attendance of 28 students. It was observed in every stages of the programme that students talked about aesthetic and unique features of the plants, they tried to memorize the Latin and local names of plants and they freely expressed their feelings and considerations. Students told that they enjoyed the visit and met plants which astonished them during the visit. When students shared their experience with students who did not attend to visit, it was observed that other students wanted to attend to the visit. Thus, it is recommended that education programmes which focus on interesting features of plants in out-of-school environment should be used in order to raise plant awareness and attitude towards plants.

Note: The educational programme, which is introduced in this study, was designed and implemented in post graduate thesis prepared by Funda Gül Iri Karadeniz. The thesis was supported by Muğla Sıtkı Koçman University, Scientific Research Projects)

**Keywords:** Plant Awareness, Attitude Towards Plant, Plant Blindness, Out-of-school Learning Environment, Botanic Garden.

## DESIGNING OUT-OF-CLASS MODELING IMPLEMENTATIONS AND ITS EXAMPLE

*Ali Özgün Özer, Esra Bukova Güzel*

This study focuses on one part of a comprehensive design-based research. The design was implemented in 9th grade level and included a sequence of modeling tasks. During the interventions, some groups have realized their solutions in outside of the classroom. For example in a car parking-related modeling task they have gathered information about the vehicles in the school garden and thus they made more realistic assumptions. Then a design including out-of-class modeling tasks was developed. The out-of-class implementations were designed on a theme named "Amusement Park". The groups selected one specific amusement park's tool and observed it in a detail way. In this process, the students interviewed with the staff of amusement park and took video records. This study focuses on one group's modeling task and their process. The purpose of the study was to examine how modeling tasks realized out-of-class and how to shape students' modeling competencies and views on modeling activities. The group's modeling task and solutions were deeply examined and their modeling competencies and views were questioned. The interview was done with the group and was recorded by a video camera. The video records of the interview were verbatim transcribed and analyzed. In addition, the solution papers of the group and their modeling competencies were evaluated with a rubric. As a result of the analysis, it was seen that the students had more attention to the modeling process and they were more creative and productive in the out-of-class modeling task. The students mentioned the reason that the classroom was crowded and that time was restricted in class activities. In out-of-class modeling tasks, they expressed that they were more motivated, more entertained and more creative by having an excursion, an unlimited time, and working in an environment where only their own groups existed, rather than crowded class.

**Keywords:** Out-of-class, Modeling Implementations, Designing Modeling Implementations



## DETERINATION OF SECONDARY SCHOOL STUDENTS' ALTERNATIVE CONCEPTIONS ABOUT IONIZATION ENERGY

*Canan Nakiboğlu, Halit Cosgun*

The topic of ionization energy places is one of the important topics of the secondary school curriculum of many countries. This topic is also placed in both 9th and 11th grade secondary chemistry curriculum in Turkey. Previous studies have indicated that students have the learning difficulty and the alternative conceptions in ionization energy topic. Taber (1999) developed an instrument to determine first-year A-level students' understanding of ionization energy in the UK. He found that a significant proportion of the students based their explanations of ionization energies on the full outer shells explanatory principle and/or the conservation of force conception rather than on Coulomb electrostatics. In this study, the true/false diagnostic instrument which contains 20 questions developed by Taber was translated in Turkish firstly. After then to provide content validity, the instrument was examined by seven chemistry teachers. To test intelligibility of each item placed in the instrument, 20 secondary school students from 11th and 12th grades were asked whether there were any items that they did not understand what this item mentioned. The test items were arranged taking into account students' answer. To provide reliability, the instrument rearranged was applied to 38 students twice. The final instrument was administered 956 students who are attending at 9th grade (269 students), 10th grades (253 students), 11th grade (236 students), and 12th grade (198 students) from nine different secondary schools. At the end of study, it was found that the students had two alternative frameworks that are the full outer shells explanatory principle and/or the conservation of force conception.

**Keywords:** Ionization Energy, Secondary Students, Alternative Conceptions

## DETERMINATION OF COGNITIVE STRUCTURE OF SCIENCE, PHYSICS, CHEMISTRY AND BIOLOGY TEACHER CANDIDATES ABOUT "ENERGY" CONCEPT THROUGH WORD ASSOCIATION TEST

*Hasene Esra Yildirim, Tuğba Işıktaş, Ayşenur Yildirim*

The word association test (WAT) is one of the techniques that help to determine whether cognitive structure of learners and the connections between the concepts in this structure are sufficient or not enough to make the relations between concepts in the long-run memory (Bahar, Johnstone & Stuccliffe, 1999). In this study, WAT is implemented for determining teacher candidates' cognitive structures. In the WAT, it is expected from the teacher candidates to express the first ten words that come to their mind when they hear the word "energy" and form a sentence with the words expressed by them. 326 teacher candidates in total have participated in this study from the Balıkesir University. In data analysis, the answers provided by each teacher candidate were analyzed following the implementation and then a frequency table was drawn. The concept network is prepared by taking advantage of this frequency table. Cut-off point technique is used in concept networking process. In addition, answer concepts given by teacher candidates about energy were categorized by content analysis. The sentences formed by the teacher candidates were categorized as "sentences containing scientific knowledge, sentences containing non-scientific and superficial knowledge and sentences containing misconceptions" with the codification system improved by Ercan et al (2010). In consequence of the analysis, it is determined that biology teacher candidates connected the concept of energy with "sun and ATP" the most; while chemistry, physics, and science teacher candidates mostly connected the concept with "potential and kinetic energy". As a result of analysis of the answer concepts, some categories were determined such as forms of energy/sources of energy, energy units/formulas, common concepts of energy in physics and chemistry, energy for the continuity of life, energy from the perspective of chemistry and the properties of energy.

**Keywords:** Energy, Cognitive Structure, Word Association Test, Teacher Candidate



## DETERMINATION OF LEARNING STYLE BASED ON GREGORC LEARNING STYLE MODEL : FACULTY OF ENGINEERING

*Ali Ozdemir, Aysegul Alaybeyoglu, Kadriye Filiz Balbal*

It is very important for individuals to know way of learning so that the lifelong learning process can be carried out efficiently, quickly and easily. For this reason, different models and learning styles have been developed by considering different characteristic features and abilities of individuals. One of these learning style models is Gregorc Learning Style Model which categorizes learning style into four groups: Abstract Sequential, Concrete Sequential, Abstract Random and Concrete Random. In this research, it was tried to determine the learning styles of the engineering faculty students and academicians. Within the scope of the study, Gregorc Learning Style Inventory and Personal Information Form were applied to 26 academicians and 60 engineering faculty students. The frequencies and percentages of the obtained data are calculated and presented. The dominant learning styles were determined according to the gender, age, department and academic degree criteria of students and instructors.

**Keywords:** Learning Style, Gregorc Learning Style Model, Engineering Education

## DETERMINATION OF PRE-SERVICE SCIENCE TEACHERS' AWARENESS OF SCIENTISTS IN THE FIELD OF ELECTRICITY/MAGNETISM

*Meryem Görecek Baybars*

The study was carried out with first year Science Teaching students studying at Education Faculty in Muğla Sıtkı Koçman University in the spring term of 2016-2017 academic year and total 74 students participated in the study. A form was designed by the researcher to determine pre-service science teachers' awareness of scientists who carried out studies about electricity and magnetism. The form aims at identifying scientists carrying out studies in the field of electricity and magnetism and their contributions to the discipline in the history of science. The pre-service teachers' responses who only completed the scientist section or the contribution of scientists to the field section in the form were not included in the evaluation for the data analysis. The frequencies and percentages of the pre-service teachers who responded correctly to both sections in the data collection tool were determined. It can be stated from the responses of the pre-service teachers that such scientists as Edison (invention of light bulb), Michael Faraday (A Faraday cage and laws of electrolysis), Benjamin Franklin (day light saving time, kite experiment, + and – electrical loads), Coulomb (the effects of electrical loads on one another) and George Simon Ohm ( Ohm's Law) stand out.

**Keywords:** Pre-service Science Teacher, Awareness Of Scientist



## DETERMINATION OF THE PRE-SERVICE SCIENCE TEACHERS' KNOWLEDGE ON ELECTRIC CURRENT TYPES

*Ümmü Gülsüm Durukan, Ayşegül Sağlam-arslan*

Know-want-learn is a strategy aimed at revealing the students' preliminary knowledge of the subject or concept, what they want to learn and what they learn at the end of the teaching process. Know-want-learn strategy is a guiding strategy that can be used; with the first question "What do I know?", the students have identified the preliminary knowledge about the subject / concept, with the second question "What do I want to learn?", the learning environment can be organized and with the final question "What do I learn?", the students have watched conceptual learning and change process. In this context, it is aimed to reflect the gains of the pre-service teachers in the process of the learning environment which is regulated within the scope of General Physics II and General Physics Laboratory II. This study was designed according to qualitative research method. The study group composed of 27 first grade pre-service science teachers (PSTs). The data were collected from three learning environments about electric current types (direct current, alternating current, and induction current) with a form containing three open ended questions. The PSTs have answered the questions "What do I know?" and "What do I want to learn?" before entering the learning environment and "What do I learn?" before leaving the learning environment. The data were analyzed by content analysis and the quotations were presented by PSTs' statements. The findings indicate that the PSTs use concepts such as amplitude instead of concepts such as current intensity and current direction while defining direct current and alternating current. The PSTs seem to be unable to explain the induction current sufficiently. In addition, it has been determined that the PSTs have alternative concepts of electric current types from their descriptions. The PSTs stated that they wanted to know how to use direct current, alternating current and induction current and where they are used. After the teaching process in learning environment, it was determined that the PSTs had sufficient explanation about the definitions of the electric current types and had knowledge about the forms of production and usage areas. It is seen that it is useful to include the applications of this strategy in the teaching process due to the fact that the PSTs can follow their own learning processes.

**Keywords:** Pre- Service Science Teacher, Direct Current, Alternating Current, Induction Current, Knowledge



## DETERMINING ASSERTIVENESS LEVEL OF HEALTH SERVICES VOCATIONAL SCHOOL STUDENTS

*Hiçran Alkan, Perihan Akbaş, Nur Akcanca, Serap Aktemur Gürler, Hatice Biçakçı*

This study performed to determine assertiveness level of students who educated in different programs in Kafkas University Atatürk Health Services Vocational School. 265 Students participated in the research based on voluntary consent. For the data obtaining, they were used Rathus Enterprisingness Inventory and questionnaire form identifying the student that contain socio-demographic properties such as gender, program, class level, family income level, family attitude, parents education and family type. Analyses of data were calculated by using t-test and one way ANOVA statistical methods in SPSS programme. Demographic properties of students were compared with Rathus Enterprisingness Inventory mean score. Rathus Enterprisingness Inventory mean score of the students was 14,92. According to the RAE score they were named, 110 students (41,5 %) were asheamed and 153 student (57,5 %) were enterprise and 2 students (0,75 %) were aggressive. In investigation of RAE scores, While students of Patient Care at Home ( =22,58, S=24,87), Geriatry ( =19,96, S=24,16) and Medical Promotion and Marketing ( =13,62, S=24,39) were enterprise, students of Medical Laboratory Techniques ( =8,92, S=8,41) and Child Development program ( =8,18, S=8,42) were asheamed. Efforts can be made to provide assertiveness training to asheamed programs.

**Keywords:** Assertiveness, Vocational School Students, Asheamed



## DETERMINING OF EIGHTH GRADE STUDENTS' UNDERSTANDING OF SOLUTION CONCEPT BY USING CONTEXT BASED CONCEPT CARTOONS

*Nail İlhan, Emre Harun Karaaslan*

In context-based approach, concepts are presented to students in according with a contexts related to daily life. Concept cartoons are considered as an effective tool because they are used to promote conceptual learning, to capture students' attention, and provide active involvement of the students in the learning process. The aim of this study is to determine of Eighth Grade Students' Understanding of Solution Concept by Using Context Based Concept Cartoons. The sample of the study was composed of 210 students eighth grade in six different state schools in the city of Kilis located in the south of Turkey. In this study, eight context-based concept cartoons were developed to reveal of students' conceptual understanding. In context-based concept cartoons that were prepared as worksheets, the context was given first. Afterwards, dialogues with concept cartoons were presented. There are three different characters in the concept cartoons. The expressions of two characters include misconceptions, while the remaining one is the correct explanation. The participant students were asked to choose a character they agree with, and they were also requested to explain why they chose that character. Context-based concept cartoons were performed in the science courses of the students during two class hours. Students' understanding of solution concept was determined by analyzing of the context-based concept cartoons filled out by the students, Content and descriptive analysis techniques were used to analyze the qualitative data. According to the results students had many misconceptions about solution concept. Explanations about the correct answers given by the students were quite inadequate.

**Keywords:** Context Based Approach, Concept Cartoons, Solution Concept

## DETERMINING PROSPECTIVE SCIENCE TEACHERS' KNOWLEDGE LEVELS RELATED TO DAILY-LIFE SCIENCE TOPICS

*Yasemin Koç, Oylum Çavdar, Seda Okumuş, Coşkun Devenci, Nilüfer Okur Akçay*

The aim of this study is to determine prospective science teachers' knowledge levels about some daily-life science topics. For this reason, it was used survey method. The sample of this research consists of 82 prospective science teachers from first (N=42) and fourth (N=40) year in science teacher education program. In order to collect data in the research, the Daily Science Topics Test (DSTT) consisting of 7 open-ended questions containing current science topics were used. For the validity of the test, 3 experts from science education were consulted. The consistency of the scorer was examined for its reliability. In order to analyze data, it was used percentage and frequency values of descriptive statistics. Findings from the research show that prospective science teacher do not have enough knowledge about daily-life science topics and they have misunderstandings. From this, it can be said that the education given in relation to daily-life science topics in higher education is not sufficient at the desired level. It is very important for the prospective teachers who will be science teachers of your future to be conscious about these subjects in university education.

**Keywords:** Prospective Science Teachers, Daily-life Science Topics



## DEVELOPING 21ST CENTURY CHEMISTRY LEARNING THROUGH DESIGNING DIGITAL GAMES

*Ah-nam Lay, Kamisah Osman*

The purpose of this study is to investigate the effect of MyKimDG (Malaysian Kimia Digital Games) module on students' achievement and motivation in chemistry as well as 21st century skills. In order to strengthen Malaysia's competitiveness in the 21st century global economy, Malaysia needs to produce students who have mastered the knowledge of chemistry and competent in the 21st century skills to become science and technology innovators. Meanwhile, students must be highly motivated so that the learning becomes more efficient. Therefore, chemistry education in Malaysia should put greater emphasis on combination of cognitive, sociocultural and motivational aspects to ensure that students are well-equipped with knowledge, skills and values relevant to the new global economy. Previous studies have reported that digital game-based learning (DGBL) provides opportunities for increasing students' motivation in learning while enhancing their academic achievement and 21st century skills. Based on the DGBL approach as well as constructivist-constructivist learning theories, an intervention module known as MyKimDG was developed as a mechanism for achieving the desired goals. In this study, we provide students the opportunity to take on the role of game designers, developing digital games while learning chemistry. This study employed quasi-experimental study with non-equivalent control group pretest-posttest control group design. Subjects were composed of 138 Form Four students from four secondary schools. Two schools were randomly selected as the treatment group and another two schools were assigned as the control group. Instruments utilized were the achievement test, the Malaysian 21st Century Skills Instrument (M-21CSI) and the Students' Motivation towards Science Learning (SMTSL) questionnaire. Results showed a significant difference between the control group and treatment group in chemistry achievement. Results also revealed that the scores of high productivity skill in M-21CSI and self-efficacy in SMTSL increased significantly between pre-test and post-test for treatment group. Our results suggest that the inclusion of student as game designer approach in chemistry learning is able to improve the acquisition of chemistry knowledge and 21st century skills while increasing motivation in chemistry.

**Keywords:** Chemistry Learning, Constructionism, Digital Game-based Learning, Learning Through Designing

## DEVELOPING WEB BASED PHP LEARNING ENVIRONMENT

*Özlem Tülek, Mehmet Emin Korkusuz*

Web-based PHP Learning Environment, an application developed to improve the success of university students in the PHP Programming Language, is discussed in this study. Research studies show that the lack of study and practice is one of the most important cause of failure of the students on programming languages. Therefore, the developed application has been designed to allow the students to practice by logging in through any computer connected to the Internet, without depending on any time or place constraint. It has been designed as a web based application. The application has been designed to have separate interfaces for both the instructor and the students. A number of exercise questions have been prepared for the students on the topics covered by the application. Also, the lecture summaries are included to remind the students of the forgotten topics during exercising. There are interfaces for the instructor to add new contents (lecture, exercise) and a bulletin board. The 3rd grade undergraduate students who take Internet Based Programming Course, have been made to use the developed application and the opinions of the students about the application have been received. Students have stated that the interface of the application was simple and practical, and that the exercises, as the content, were useful for them. Because the use of the application is very practical, the students have also explained that they have been running and testing their own codes, as well as the exercises in the application, in this environment. Also, they have stated that the application could be improved by some enhancements in the lecture section such as video lecturing of complex and detailed examples.

**Keywords:** Programming Teaching, Php, Material Development



## DEVELOPMENT OF AN ATTITUDE SCALE TO ASSESS TEACHERS' ATTITUDES TOWARD EDUCATIONAL INFORMATION NETWORK (EBA)

*Burcu Uğurlu, Gülden Gürsoy*

In this study, it is aimed to develop a scale that determines teachers' attitudes towards educational information network (EBA). The sample of the research is composed of 242 teachers working in secondary education in central district of Adiyaman province and Kahta province in 2015-2016 academic year. While determining the items of the scale, a wide range of literature searches were conducted and various scales previously developed in the likert type were examined. Six interviews were conducted with 19 teachers about the network of education and training. 80 draft statements have been identified in the light of the interviews and the literature reviewed. The number of items in the draft has been reduced to 52 after knocking down similar items. Lawshe technique was used to determine content validity of scale. An opinion form was filled for Lawshe technique by 10 experts. Eleven items were extracted from the scale according to the content validity indices calculated after the expert opinion. The scale consisting of 41 items was applied to teachers in different branches working in secondary education. The Barlett test and Kaiser-Maiser Olkin test was performed to determine whether the data from the scale were fit for factor analysis. At the end of the analysis, KMO value was found to be .945 and the Barlett test was statistically significant ( $p \leq 0.05$ ). These results showed that the scale was appropriate for factor analysis. Explanatory factor analysis (exploratory) and varimax transformation methods were used to determine the factors and items to be included in the scale. As a result of the analysis, 26 items which have been construct validity were included in the last scale. Factors that were gathered under four sub-factors were named the contribution to the teaching process, the concern about technical problems, the occupational concern, and the contribution of students. The Cronbach Alpha internal consistency coefficient of the scale was calculated as .88. As a result of the research, it was found that the scale prepared is valid and reliable for determining the attitudes of teachers towards use of educational information network.

**Keywords:** Educational Information Network (eba), Attitude, Scale

## DEVELOPMENTAL SEQUENCE OF COUNTING PRINCIPLES USED BY PRESCHOOL CHILDREN

*Mesut Saçkes, Sonnur Işitan, Kerem Avcı*

In this study, the age-related development of the counting principles used by children aged 36-66 months was examined. The sample of the study constituted a total of 49 children, 23 girls and 26 boys, attending an official kindergarten in the center of Balıkesir. An interview protocol that included six questions was used to assess children's counting skills. The interviews were conducted individually in a quiet place with children and lasted less than 10 minutes. The results indicated that the abstraction principle and the cardinality principle were underdeveloped in comparison to other principles. There was a sex difference favoring girls, girls more likely to perform better in counting tasks than boys.

**Keywords:** Early Childhood, Counting Principles, Rational Counting



## DIFFERENCES BETWEEN PRESERVICE MIDDLE SCHOOL MATHEMATICS TEACHERS' PROOF LEVELS ABOUT CIRCLES WITH CAND WITHOUT ARGUMENTATIONS

*Tuğba Uygun, Pinar Güner*

Argumentations can be useful to produce mathematical proofs having important role in mathematics and also mathematics education (Pedemonte, 2007). In mathematics education, link between argumentation and proof is often emphasized since argumentations as a kind of reasoning and social behavior encouraging logical discourse and enhancing production of conjectures might promote construction of proofs (Pedemonte, 2007; Reid & Knipping, 2010). In this respect, in mathematics education, there have been research investigating argumentations, proofs or both of them together. Previous research in the literature show that argumentation activities encourages and facilitates proof production processes (Boero et al., 1996; Garuti et al., 1996; Mariotti, 2001). In this respect, the current qualitative research focused on the link between argumentation and proof. Therefore, the purpose of the study was to examine the effect of argumentations on preservice middle school mathematics teachers' (PMSMT) proofs. Their proof levels were examined based on the study of Balacheff (1988). Balacheff (1988) focus on students' proof levels by separating them into three groups. These groups are sorted from the lowest level to highest level; pragmatic proof, intellectual proof and demonstration proof. In pragmatics proof level, proofs are produced using examples and particular cases. In intellectual proof level, proofs are based on formulization systems and processes. In the last level, demonstration proof level, proofs are formed relating theorems and knowledge generally accepted as true in mathematics. The sample of the study was composed of 20 junior PMSMT. In the data collection process, the PMSMT firstly worked on some problems about proofs of circles individually. Then, they participated in whole class discussions and formed argumentations related to proofs of circles explained in the problems. Afterwards, the PMSMT's proof levels determined based on proofs produced in worksheets and through argumentations were compared. The qualitative data have been analyzed by Toulmin's argumentation model and Balacheff's proof levels. The results obtained through data analysis process and implications based on them will be stated.

**Keywords:** Argumentation, Circle, Proof Level.


## DISCOVERY OF THE POLYGONS AND THE SUM OF THE INTERIOR ANGLES OF A POLYGON BY THE LAKOTASIAN DISCOVERY STRATEGY: A CASE STUDY

*Ayhan Aksoy, Kemal Koç*

In his 1976 book, *Proofs and Refutations*, Lakatos presents a collection of case studies to illustrate methods of mathematical discovery in the history of mathematics. These methods are reframed in many ways that make them more amenable for use as a framework for research on learning and teaching mathematics. In this study, we analyse a case study of seven students working together on the polygons and the sum of their interior angles. Students were asked to produce conjectures and to validate them within the dynamic mathematics environment GeoGebra. Our study illustrates the process of the evolution and refinement over time of a definition and/or a proof and also shows the opportunities for Lakatos' discovery strategy in terms of learning mathematics.

**Keywords:** Lakotasian Discovery Strategy, Dynamic Mathematics Software, Polygons

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## DOES THE TYPE OF PROBLEM SOLVING QUESTIONS IMPACT TO THE EMERGENCE OF COGNITIVE UNITY? A CASE OF STUDENTS' MATHEMATICAL ARGUMENTATION

*Zeni Rofiqoh*

This study examines the argumentation process during small group discussion on problem solving questions of seventh grade students in Bristol, United Kingdom. The purpose of this research is to analyse the continuity between their process in expressing some ideas and reasons when solving problems and the obtained solutions. By using the Toulmin's model of argumentation to investigate the cognitive unity, the main results show that cognitive unity does not always appear in every kind of problem solving question. However, it does not necessarily mean that students failed in solving problem. Although cognitive unity could not be identified in all sorts of problem solving questions, this study found that students demonstrated their problem solving's steps throughout Polya's problem solving framework.

**Keywords:** Problem Solving, Mathematical Argumentation, Cognitive Unity

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## EDUCATIONAL MODELS AND CURRICULUMS OF PHOTONICS FOR SUSTAINABLE DEVELOPMENT

*Burcu Uğurlu, Altay Firat, Arif Sari*

Escalation of problems in the education system and failure to achieve desired level of success in education has led to the emergence of the need for a new educational approach. The up to date curricula and programs for photonic education has many negative and positive consequences of program outcomes on economic indicators. The sustainable education covers an infrastructural education policy that allows students to reinforce theory with field practice with non-rota based learning model. The impact of the required learning models on students motivation is discussed in this research. Required subjects should take place in curriculums in the field of photonics for the sustainable education. Curriculums designed for students that covers required subjects that prepare them to be main and intermediate staff in the field of photonics has great importance in terms of sustainability. This study provides information on the advantages and disadvantages of verstaile education on students and expose the curriculums designed for

students that covers required subjects in field of photonics will reveal the dominant contribution to the training of personnel to work fully mastered in this field.

**Keywords:** Education System, Photonic, Education, Learning, Curriculum, Sustainability



## EFFECT OF PROBLEM SOLVING TRAINING ON 7TH GRADERS' BRAIN HEMISPHERIC DOMINANCE

*Gizem Yapar Söğüt, Yeliz Yazgan*

People use some part of their brains more effectively and this situation is called as brain dominance (Hermann, 1999). The people who have the left hemispheric dominance solve the problems by partitioning, writing equation, and using oral and logic explanations; oppositely, the people who have the right hemispheric dominance prefer focusing the whole, drawing diagram and using visuals during problem solving. On the other hand, the left hemisphere and the right hemisphere must work cooperatively and equally in order to make brain achieve the highest capacity (Boydak, 2004; Caine & Caine, 1999; Davis, Hersh & Marchisotto, 2012). Purpose of this study is to investigate whether a training including only non-routine problems affects their brain hemispheric dominance of 7th grade students. In this study, which has an experimental group consisting 21 seventh graders, one sample experimental design was used. Firstly, the brain hemisphericity inventory was applied to students to find out their brain hemispheric dominance. Then a problem solving training was implemented to experimental group over eighteen lesson hours. 80 mathematical non-routine problems were used during the implementation. After the implementation, the brain hemisphericity inventory was applied to students again. As a result, a training including non-routine problem solving has a significant effect on the brain dominance of 7th grade students. On the contrary to decrease in the number of students having left brain dominance, there is a sudden increase in the number of students having right brain dominance and a slight increase in the number of students having equal brain dominance. In fact, a major part of 7th grade students having left brain dominance shows right brain dominance after problem solving training. It is suggested that the importance given to problem solving should be increased in order to stimulate students' both brain hemispheres and to increase the students' use hemispheres equally.

**Keywords:** Brain Hemisphericity, Brain Hemispheric Dominance, Problem Solving, Non-routine Problem, Mathematics Education



## EFFECT OF STEM-5E LEARNING CYCLE (AM-STEM KIDS MODULE) IN FOSTERING NOBLE VALUES AMONG ELEMENTARY SCHOOL CHILDREN

*Nurazidawati Mohamad Arsad, Kamisah Osman, Mohamed Amin Embi*

The purpose of this study is to investigate the effect of STEM-5E learning cycle intervention (AM-STEM Kids module) in fostering noble values among elementary school children. The elements of noble values consists of: (i) being thankful to God, (ii) being cooperative, (iii) thinking rationally, (iv) appreciating the contribution of science and technology, and (v) being fair and just. This study employed quasi-experimental with non-equivalent pretest and posttest control group design. A total of 119 fifth-grade children from two schools were selected as respondents and each of the school was treated as treatment and control group. The treatment group using AM-STEM Kids module while the control group experienced conventional inquiry teaching approach. Questionnaires were used to examine the perception of noble values by the children before and after the designed learning activities. MANOVA repeated measure and paired sample

t-test were used to identify the effect and the existence of significant changes in the children's noble values between treatment and control group. The finding of the study revealed that there was a significant changes in the mean score for treatment and control group in term of appreciating the contribution of science and technology, and being fair and just. Data also shows the effect size of treatment group is higher as compared to the control group. The result of this study conclude that, AM-STEM Kids module is effective in fostering children's noble values and hence could be use as teaching resources in fostering noble values in science classroom.

**Keywords:** Noble Values, Stem, 5e Learning Cycle, Inquiry Based Learning



## EFFECT OF TRADITIONAL METHODS IN NUMBERS LEARNING DOMAIN ON ACADEMIC ACHIEVEMENT: A META-ANALYSIS STUDY

*Ali Kiş, Ismail Şan*

Effect of traditional methods in numbers learning domain on academic achievement has not been conclusively studied by researchers yet. On the other hand, it is claimed that almost all experimental designed studies aiming to determine the effect of "modern" teaching methods, have utilized traditional methods in their control group. While there are some review studies within the literature, for experimental groups' effects on academic achievement, no review studies on control groups' effect have been detected so far. Consequently, our aim is to systematically review the studies' control group findings on traditional methods in experimental researches. The purpose of this meta-analysis study is to calculate the overall effect of traditional methods in Numbers Learning Domain (NLD) on academic achievement. With this in mind, data was collected from the master and doctoral theses submitted in Turkey, to indirectly answer the following research question: "Does traditional methods in NLD effect students' academic achievement?" A meta-analysis aims to compare and combine the findings from various independent studies on a subject and determine their overall effect. Data sources of the study are studies giving pretest and posttest values for their control groups from the studies with pretest and posttest experimental and control group designs on NLD. Included studies were retrieved from Advanced Thesis Search Database of The Board of Higher Education (YÖK), using keywords search "number", "mathematics" and "control" (both in Turkish and in English). The theses on NLD and using middle school (5th to 8th grades) as the sample were included into the meta-analysis considering the inclusion criteria. So far, first results indicate that there is a statistically significant positive and large effect in favour of posttest. The analysis process of the study and report writing is still continuing. If proceeding is accepted for presentation, full text of the study will be submitted and shared with participants of the congress.

**Keywords:** Numbers Learning Domain, Meta-analysis, Traditional Method, Academic Achievement



## EIGHTH GRADE STUDENTS' GRAPH COMPREHENSION AND CONSTRUCTION ABILITY WHEN SOLVING STATISTICAL PROBLEMS

*Nadide Yilmaz*

Developing students' graph comprehension has become an important task of mathematics and statistics educators (Shaughnessy, 2007). Levels of graph comprehension (Curcio, 1987) has been used to study student's processes by mathematics and statistics educators (Friel, Curcio & Bright, 2001). This graph comprehension levels are reading the data, reading between the data and reading beyond the data. Reading the data include iterating data from a graph. In this level there is no interpretation. Reading between the data involves comparing, interpolating, interpreting or integrating data in the graph. Reading beyond the data requires making future predictions. In this level reader making inference which is made based on information in the reader's mind. Another important element of graphing skill is "construction of

graph” which includes choosing, labelling axes, deciding units and tracing out points (Leinhardt, Zaslavsky & Stein, 1990). NCTM (2001) and MoNE (Ministry of National Education) (2013) recommends, each grade level to be given an importance on data analysis within mathematics curriculum. Therefore this study investigated students comprehension and construction abilities of different graph types. In addition students’ views and evaluations of this process was examined. There were 20 eighth grade students in middle school located in Turkey. Purposeful sampling (Patton, 2015) was used to identify these students that had low, middle and high success level. Because this study was aimed to determine how all of level influenced, this process. Their responses were coded according to Curcio (1989) data comprehension level and construction of graph ability. This was a qualitative research study. Data were collected by statistics tasks which include a bar, circle and line graph, students’ reflection papers and classroom discussions. The tasks were produced based on Curcio’s (1989) data comprehension activities and experts opinions. Findings showed that when students construct any kind of graph, there were some problems with this process. They were more successful reading the data than reading between the data and reading beyond the data. One of the findings of this study is that students’ have a lack of knowledge in reading between and beyond the data. Furthermore, students’ graph comprehension are discussed and some recommendations are suggested.

**Keywords:** Data Analysis And Statistics, Instructional Activities And Practices, Middle School Education



## ELEMENTARY SCHOOL STUDENTS’ VIEWS ABOUT THEIR ENVIRONMENTS BY DRAWING-WRITING TECHNIQUE

*Gülcan Çetin, Ebru Işık*

The study was aimed to define the elementary students’ views about their environments by drawing-writing technique. Participants contained ninety 6-8 grade students studied in a private high school in İstanbul in the fall semester of 2011-2012 academic years. In the study qualitative research approach was used. Drawing-writing survey was used as data collecting tool. Data were analyzed by using descriptive and content analysis techniques. Study results revealed that the students’ explanations and drawings about environment were supported each other.

**Keywords:** Environment, Environmental Education, Drawing-writing Technique, Scence Education, Elementary Education



## ETHICAL ISSUES IN ENGINEERING EDUCATION

*Ameneh Alipour, Farhad Balash*

This study aims to reveal the ethical issues in engineering education in Iran. Basically, academic ethics seem to be highly impacted by different factors in universities. In this study the researchers tried to discover those ethical issues that were perceived by the lecturers and students. The data were collected through the interviews and Delphi-Analytic Hierarchy Process technique was applied to analyze the data. The samples of the study were selected from those engineers that recently they were graduated from different Iranian universities and some lecturers. The results show that priority of ethical issues which were perceived by the students is different from the lecturers.

**Keywords:** Ethics, Engineering Education, Ahp



## EVALUATION OF MATHEMATICAL GAMES IN TERMS OF EDUCATIONAL ASPECTS: ANDROID AND WEB APPLICATIONS

*Ayfer Alper, Tuğçe Gençoğlu*

Nowadays interactive education is becoming widespread by using smartboards and pad computers. In addition it is observed that by mathematical games and game assisted teaching, the attitude and success level towards mathematics is increasing day by day. Accordingly, especially in digital platforms, as in many disciplines, many games are recently being developed also in Mathematics and the children are enabled to play. However, considering that these games are not only fun aimed and they have educational aspects, these kinds of games should have some specific characteristics. In this study, the android and web applications in Edshelf and PlayStore that can be used in mathematics education were evaluated according to various criteria.

**Keywords:** Mathematic Games, Game Based Learning, Instructional Design



## EVOLUTION TEACHING SELF EFFICACY SCALE: VALIDITY AND RELIABILITY STUDY

*Sibel Inan, Serhat Irez, Çiğdem Han-tosunoğlu, Mustafa Çakır*

The purpose of this study is to develop a valid and reliable instrument for measuring prospective biology teachers' self efficacy beliefs about teaching evolution. The research was conducted on a study group consisted of 212 prospective biology teachers studying in an urban university in 2015-2016 school year. Evidence for content validity is established through literature review of related content and expert opinions. Exploratory Factor Analysis (EFA) is performed in order to establish the scale's construct validity. As a result of EFA, a 11-item and a two-factor structure model that explains 57.9% of the total variance is obtained. The emerging factors were called as "self efficacy of general content knowledge of evolution" and "self-efficacy of teaching evolution". The scale's reliability coefficient and item-total correlations are calculated. Cronbach alpha coefficient of the scale is 0,87. Internal consistency coefficients for the sub-scales varied between 0,81 and 0,83 and found to be within admissible limits. In light of these results, it could be argued that the scale is reliable and valid instrument and can be used in identifying prospective biology teachers' self efficacy beliefs about teaching evolution.

**Keywords:** Evolution Teaching Self-efficacy, Scale Development

## EXAMINATION OF HIGH SCHOOL STUDENTS' ENVIRONMENTAL ATTITUDES ACCORDING TO THEIR LOGICAL/ INTUITIVE THINKING AND EMOTIONAL INTELLIGENCE

*Canan Koçak Altundağ, Ayşem Seda Önen*

The purpose of the environmental education is to educate individuals as environment friendly persons who are sensitive to their environments and who have positive attitudes and behaviors towards environmental issues. Hence, it would be very beneficial to determine the factors which affect the attitudes of the students on the environmental issues. The aim of this study was to examine the relationship between high school students' emotional intelligence, logical and intuitive thinking skills and attitudes towards environment. The study sample consists of 994 students enrolled in high schools in downtown Ankara. To determine the students' logical and intuitive thinking styles, the "Logical/ Intuitive Thinking Scale" developed by Pacini and Epstein (1999) and adapted by Turk (2077). In order to determine student's EQ levels, Emotional Intelligence Scale developed originally by Schutte et. al. (1998), which was later modified by Austin et.al. (2004) and translated into Turkish by Gocet (2006), was administered. The final assesment

tool that was used in the study was the “Environmental Attitude Scale” developed by Unal (2010). The analysis concluded that there were positively significant relationships between student’s scores at the three assessment tools.

**Keywords:** Environmental Education, Environmental Attitude, Emotional Intelligence, Logical/ Intuitive Thinking.



## EXAMINATION OF PRE-SERVICE PHYSICS TEACHERS’ TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE AND ITS COMPONENTS

*Feral Ogan-bekiroglu, Ozge Krabuz*

Integration of educational technology in science teaching has become an important issue. Therefore, considerable interest has surfaced in using the notion of Technological Pedagogical Content Knowledge (TPCK) as a framework for the teacher knowledge required for effective technology integration. The TPCK framework describes how teachers’ understandings of technology, pedagogy, and content can interact with one another to produce effective discipline-based teaching with educational technologies. TPCK consists of the following components: Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK) and Technological Pedagogical Knowledge (TPK). The purposes of this research were to determine pre-service physics teachers’ TPCK while they were using calculator based laboratory (CBL) in their teaching practices and to identify which components had the most influence on their TPCK. Both quantitative and qualitative data including inventories, observation forms and interview protocols were collected to measure the participants’ qualifications in each component. Their TPCK were determined by examining their lesson plans, by observing their teaching practices, and by interviewing them after their teaching. Findings showed that a half of the pre-service physics teachers’ had sophisticated TPCK while 30% of the participants’ TPCK was in good level. Results also presented that both the participants’ technology awareness and their thoughts about using effective technology in class had significant high positive relationships with their TPCK. Moreover, there was a significant high positive correlation between their educational philosophy and TPCK. High correlations were also found between the pre-service teachers’ thoughts about teaching and TPCK and between their lesson plans and TPCK. These results reached the conclusion that PK, TPK, and PCK are the components that have high influence on TPCK. This study suggests that teacher education programs should focus on improving teacher candidates’ pedagogy, technological pedagogy and pedagogical content knowledge to gain progress in advancing their TPCK.

**Keywords:** Tpk, Teacher Education, Physics



## EXAMINATION OF PRESERVICE MIDDLE SCHOOL TEACHERS’ NATURE OF PEDAGOGICAL CONTENT KNOWLEDGE IN PERIMETER

*Pinar Güner, Tuğba Uygun*

Teachers should know how to teach a specific subject, how to present and respond to particular students and how to use materials and tasks in curriculum (Kılıç, 2011). It refers to pedagogical content knowledge and it has important effects on teachers’ planning, teaching, classroom actions (Van Driel, Verloop, & De Vos, 1998), students’ learning (Carpenter, Fennema, Peterson, & Carey, 1988) and qualified instruction (Park & Oliver, 2008). Shulman (1987) describes this concept as a combination of content and pedagogical

knowledge because it involves to know how to teach a particular subject matter. However, teachers also need to have knowledge about students and curriculum for providing effective teaching and learning (An, Kulm, & Wu, 2004). Therefore, these are accepted as essential components of PCK in many studies. Besides, these components are useful for examining knowledge of teachers and preservice teachers since it serves as a map to interpret the information (Friedrichsen, 2008). In this direction, the purpose of this study is to present the nature of preservice middle school mathematics teachers' pedagogical content knowledge as emerged from the process of planning a lesson regarding the subject of perimeter in fifth grades. Case study, one of the qualitative research designs, was used to gain an in-depth understanding of the situation. Four senior preservice teachers participated in the study and the data were obtained from the video recordings of planning the lesson. The transcripts of the videos were analyzed through content analysis method. Pedagogical content knowledge of preservice teachers was examined based on its essential components which are knowledge of subject matter, knowledge of pedagogy, knowledge of students and knowledge of curriculum. The results obtained through data analysis process and implications based on them will be stated.

**Keywords:** Pedagogical Content Knowledge, Preservice Teachers, Perimeter



## EXAMINATION OF SECONDARY SCHOOL STUDENTS' CONCEPTIONS ABOUT METALLIC BONDING AND PROPERTIES OF METALS

*Canan Nakiboğlu*

Understanding chemical bonding and the particulate nature of structures are fundamental to success in chemistry. Although a number of alternative conceptions related to covalent and ionic bonding have been described in the literature, there are very few studies investigate students' understanding metallic bonding. Besides, students often have considerable difficulty in using atomic/molecular level models of matter to explain the properties of substances. Metallic bonding and properties of metals place in the secondary school curriculum of many countries. For this reason to investigate high school students' conceptions about metallic bonding and properties of metals is important. A diagnostic instrument titled "iron" was designed to test out student understanding of the basic notion of metallic bonding and the relation between the properties of particles and bulk properties by Taber (2002). In the present study, a translated version of the true/false diagnostic instrument which contains 20 questions was administered to 942 students who are attending at 10th grades (374 students), 11th grade (333 students), and 12th grade (235 students) from different secondary schools. At the end of the study, it was found that the students had the octet rule alternative framework. They apply the full outer shells explanatory principle to explain metallic structure. It was concluded that students have alternative conceptions about the relationship between the properties of metal atoms and the properties of the metallic structure. For example, most of the students think "iron conducts electricity because iron atoms are electrical conductors" and "the reason iron rusts is that iron atoms will rust if exposed to damp air".

Taber, K. S. (2002). Chemical misconceptions- prevention, diagnosis and cure, Volume II: classroom resources. London: The Royal Society of Chemistry.

**Keywords:** Metallic Bonding, Secondary School Students, Metallic Properties

## EXAMINATION OF SEVENTH GRADE STUDENTS' USING MATHEMATICAL LANGUAGE IN THE LINES AND ANGLES SUBJECT

*Zehra Ünal, Büşra Günkaya, Ayşe Tekin Dede, Süha Yılmaz*

The difficulties in the field of geometry which is one of the basic learning areas of mathematics are discussed in studies. It is believed that a number of difficulties may arise from the mathematical language used. The mathematical language used correctly in the lines and angles subject considered as one of the fundamental topics of geometry is thought to contribute positively to the teaching of the following subjects. In this context, it is aimed to investigate the level of mathematical language use of the 7th grade students in the lines and angles subject. Participants of the study are 199 seventh-grade students studying at five different schools. Data collection tools are an achievement test developed for students to determine the levels of mathematical language usage in the lines and angles subject and mathematical language scale aiming to determine the students' attitudes towards mathematical language usage. The results from the analysis of the data showed that the students' level of mathematical language use was generally moderate, did not differ according to gender, and there was a positive correlation with academic achievement. It was determined that there was a positive relation between the mathematical language usage levels and the problem formation, concept formation and transformation to shape which were the dimensions of the mathematical language scale.

**Keywords:** Mathematical Language, Line, Angle, Geometry, Seventh Grade



## EXAMINING INTERNET ADDICTION LEVELS OF PRIMARY 4TH CLASS STUDENTS

*Hasan Aydemir, Mustafa Çınar, Yalçın Karali*

In this study, the situation of the addiction to the internet of the students who continue their education primary schools has been examined by several variables. The students who continue their education year of 2016-2017 in in Malatya, Yeşilyurt primary schools universe of the study. The model of research is relational screening model. In order to determine the levels of addiction to the internet of the students, the Internet Addiction Scale which was developed by Günüç (2009) was used in the research. Results and conclusion will be given in the full text.

**Keywords:** Internet, Internet Addiction, Addiction



## EXAMINING PHYSICS EXPERIMENT REPORTS OF PRE-SERVICE SCIENCE TEACHERS AND DETERMINING THEIR POINT OF VIEW ABOUT EXPERIMENT REPORTS

*Ümmü Gülsüm Durukan, Funda Hasançebi*

The most important advantage of science courses compared to other courses is; in these courses, theoretical knowledge can be converted into practical knowledge through laboratories. In this respect, laboratories in which practices are realized, are an integral part of science education. Especially it is known that teaching by laboratory activities is effective not only in solving the difficulties encountered by the students but also in closely monitoring the development process of the students. The experimenting process provides students the opportunity to acquire concrete experiences in terms of both learning

science concepts and the application of the information access process. As laboratory method is very important in teaching science, it is the responsibility of science teachers to use this method, to design and implement activities / experiments. In this context, teachers can use the prepared laboratory books and also they should be able to carry out the laboratory studies by designing the activities themselves when necessary and reach the aims of scientific experiments. In this context, it is expected that the pre-service science teachers (PSTs) should educate themselves about on laboratory courses and experiments so that they will be able to design, conduct and guide their own experiments in their lessons. The aim of this study is to examine the reports prepared by the PSTs for the experiments on direct current during General Physics II Laboratory course and to reveal the attitudes of the PSTs towards report preparation process and the course itself (physics laboratory). This study is carried out the case-study method. The study group is composed of 76 pre-service science teachers. A total of 346 reports prepared by the PSTs for these experiments during the study were analyzed by document analysis. By using a form prepared by the researchers, the data that reveal the PSTs' viewpoints of the report preparation process have been obtained and these data were analyzed by content analysis. The 'Physics Laboratory Attitude Scale' developed by Tanrıverdi and Demirbaş (2012) was used to reveal the attitudes of the PSTs towards the physics laboratory course. The analysis of the obtained data still continues. The primary findings obtained from the analysis of the reports demonstrate that the PSTs have difficulty in preparing the theoretical knowledge about the experiment, performing calculations based on the data and drawing graphs.

**Keywords:** General Physics I Laboratory, Direct Current Experiments, Pre-service Science Teacher, Experiment Report.



## EXAMINING THE EFFECT OF WRITING TO LEARN ACTIVITIES AND PEER EVALUATIONS ON LEARNING GENERAL PHYSICS I LABORATORY

*Emre Yıldız, Gülşen Koçak, Sabriye Seven*

This research has been carried out with the aim of showing the effects of evaluating letters and posters works in writing for learning by teacher candidates on academic successes of teacher candidates in science education, comparing letter and poster preparation skills and determining whether or not there are any links between letter and poster works and academic achievement. Quantitative research method has been preferred and pretest-posttest quasi-experimental design has been used in the research. The research has been conducted with 84 teacher candidates from the class of General Physics Laboratory –I at Atatürk University, in fall semester of 2016-2017 education year. 20 of the teacher candidates make up experimental group 1 in which they have prepared letters in writing for learning and 23 of them make up experimental group 2 in which they have prepared posters and 18 of them make up experimental group 3 in which they have written classical experiment report as well as evaluating the letters and posters and 23 of the candidates make the control group in which they have only written classical experiment report. As data collecting tool, prior knowledge test and academic achievement test have been used. In order to analyze the data, descriptive statistics, single factor ANOVA, independent samples, t-test and correlation analysis have been used. It has been revealed that there is no significant difference between preliminary knowledge levels of the candidates. At the end of the practicing, a significant difference between the academic achievements of teacher candidates have been seen it has been shown that this significant difference has been in favor of letter group between letter-poster and letter-classical experiment groups. It is also concluded that there is no significant difference between the skills of teacher candidates in preparing letters and posters. In addition, there is no statistically significant relation between the points of writing for learning-academic achievement, letters preparing skills- academic achievement and poster preparing skills- academic achievement.

**Keywords:** Writing To Learn, Preparing Poster, Writing Letter, Science Education

## EXAMINING THE EFFECTS OF NAPIER'S BONES MATERIAL ON VISUALLY-IMPAIRED AND DYSCALCULIAC STUDENTS' MULTIPLICATION AND DIVISION ABILITIES

*Elvan Başoğlu*

The study aims to find out the effects of Napier's Bones Material on visually-impaired and Math-learning disabled students for learning multiplication and division abilities. Therefore, a semi-experimental study was designed to see how much that material could contribute to students' operation ease. Napier's Bones is the first practical calculator in the world designed by John Napier. Mathematical operations like multiplication, division and extraction, even with large numbers, can easily be made with the help of this method. A semi-experimental pattern for a single group with pre- and post-tests as a quantitative research method was used in order to determine on the effect of the material. The reason for preferring such a pattern is that students with both visually-impaired and math-learning difficulties are unable to answer the questions in existing tests, so a control group was not included in the study. Moreover, a testing was conducted to determine the comparison criteria for the experimental group as well as the reliability and equivalence with and non-disabled students. As the sample of the study, the experimental group was constituted of 8 visually-impaired and 3 Math-learning disabled students at 6th grade whereas the comparison group involved 42 students. When the equivalence of pre- and post-tests are analyzed, it is seen that there is no significant difference statistically ( $t_{41}=0.350$ ,  $p > 0.05$ ),  $r = 0.73$  ( $p < 0.01$ ). When the results were examined, it was clear that the developed material significantly increased the four-digit numbered multiplication and division skills of students with visually-impaired and Math-learning difficulties. Moreover, the results indicate that those students are at the same level of accomplishment with normal students by using the material developed. This shows that Napier Bones Material has a positive impact on the success of students with visually-impaired and Math-learning difficulties with large numbers of multiplication and division processes.

**Keywords:** Napier Bones, Visually-impaired, Dyscalculiac Students

## EXAMINING THE SELF-SUFFICIENCY LEVELS OF CLASS TEACHER CANDIDATES ON TEACHING THE TOPICS IN PROMARY SCHOOL MATHEMATICES PROGRAM ACCORDING TO THEIR GRADES

*Güler Çavuşoğlu, Nesrin Özsoy*

The purpose of this study is to examine the self-sufficiency levels of class teacher candidates on teaching the topics given in Primary School Mathematics Program according to their grades. For this purpose, a questionnaire was applied to 350 students who were attending to two state universities in 2015 - 2016 Academic year. 17,4% of the participants were 1st graders; 28,9% were 2nd graders; 45,4% were 3rd graders; and 8,3% were 4th graders. The literature review method was used in the study. the data obtained as a result of the questionnaire application was analyzed by using SPSS 22.0 program. The reliability analysis was made for the self-sufficiency level on teaching mathematics topics scale and the Cronbach's Alfa value was computed as 0,976; therefore, it is possible to claim that the scale is reliable according to Alpha criterion. The issue of whether the participants feeling ready to teach the mathematics topics varied according to grades was tested with One-Way Variance Analysis. As a result of the paired comparisons made with LSD test, the following results were achieved about the source of the difference:

- The readiness level of the participants who were at the 1st grade was higher than those at 2nd and 3rd grades on natural numbers, addition, subtraction, multiplication, addition with fractions.
- The readiness level of the participants who were at the 1st grade was higher than those at 3rd grades on division and subtraction with fractions, and their readiness level on circles was lower.
- The readiness level of the participants who were at the 1st and 4th grades was higher than those at 2nd and 3rd grades on fractions.
- The readiness level of the participants who were at the 2nd grade was higher than those at 1st and 3rd grades on spatial relations.

- The readiness level of the participants who were at the 1st grade was lower than those at 3rd and 4th grades on geometric objects, equation and our money topics.
  - The readiness level of the participants who were at the 3rd grade was higher than those at 1st and 2nd grades on measuring time.
  - The readiness level of the participants who were at the 1st and 2nd grades grade was lower than those at 3rd and 4th grades on ornamentation, measuring the liquids, and weighing.
- It was recommended that the variety of the mathematics classes taught at class teachers department at education faculties is increased, and made to comply with the primary school program.

**Keywords:** Class Teachers, Mathematics Sufficiency, Grade Level.



## FIRST REFLECTIONS OF TEACHERS TO INTEGRATED TEACHING

*Zerrin Doğança Küçük, Gürsu Aşık, Başak Helvacı, Mehmet Sencer Çorlu*

Our knowledge base on the education of STEM (or STEM Education) emphasizes a need for professional development of teachers, despite certain challenges are already well-known by teacher educators. One of these major challenges is the lack of solid evidence on how teachers should be educated to integrate STEM subjects. STEM: Integrated Teaching Framework provides teacher education researchers with a well-rounded baseline for designing and evaluating professional development programs. The present study, which is grounded in this framework, investigates how teachers perceive and act upon integrated teaching at the beginning of a year-long professional development program. The participants of this program are middle and high school mathematics and science teachers (N = 171) who are asked to design their own lessons after the first cycle of the PD program. Data are collected at this stage with a survey of open-ended questions to which teachers responded after their first implementation cycle. Data are qualitatively analyzed within the naturalistic inquiry. The preliminary findings indicate that teachers report a discomfort for not being able to fully implement what they learned during the first cycle of the PD program. Several teachers attribute—as they describe—these negative feelings to external factors. The results of the study have the potential to inform teacher educators on the initial challenges of implementing similar PD programs.

**Keywords:** Stem Education, Teachers' Self-reflection, Integrated Teaching



## FIRST YEAR NURSING STUDENTS' COPING STRATEGIES IN STRESSFUL CLINICAL PRACTICE SITUATIONS

*Iwona Bodys-cupak, Anna Majda, Justyna Skowron, Joanna Zalewska-puchała, Aneta Trzcińska*

Introduction: Performing the social service professions, to which a profession of nurse includes, is considered one of the most stress-inducing jobs. The reason behind this is deep emotional involvement in contact with patient followed by responsibility for human health and life. The time dedicated to gaining knowledge and practical skills constitutes both a potential stress source for the nursing students and provides them with the opportunity to learn how to cope with it. Aim of the study: This study aims at assessing the level of stress in difficult situations, differentiating the methods of stress coping and difficult situations for the nursing studies in the course of practical training. Material and method: 110 first-year students of intramural studies at the Nursing Faculty, State Higher Vocational School in Tarnów (southern

Poland) were surveyed using the research tools include the author's survey questionnaire, Perceived Stress Scale, Inventory to Measure Coping Strategies with Stress. Differences between variables were verified using the chi-square ( $\chi^2$ ) independence test and Mann - Whitney test. The adopted significance level was  $\alpha=0.05$ . During the first practical training, the nursing students struggled with multiple difficult situation (and perceived moderate and high stress and their attempts to cope with stress were diversified. Increase in stress level was accompanied by higher frequency of stresscopying strategies by avoidance behaviours ( $\chi^2=7.59$ ;  $p=0.02$ ). Students in difficult situations have more frequently applied coping strategies involving focusing on the issue of concern rather than emotion-based strategies. One should develop active methods of coping with stress and difficult situations with the nursing students, including in particular these manifesting helplessness and avoidance behaviours.

**Keywords:** Stress, Coping, Student, Clinical Practice



## FIRST-YEAR-MIDDLE SCHOOL STUDENTS' MODELING PROCESSES: TAXI PROBLEM

*Neslihan Şahin, Ali Eraslan*

In the twenty-first century, model and modeling approaches that support the high-level thinking skills are increasingly important in mathematics education. These skills needed at all levels of students' school life are constantly emphasized by the majority of the educators, which they need to be developed. Model Eliciting Activities (MEAs) in mathematics teaching can be an important tool in the development of such skills because MEAs enable students to analyze mathematical real-life situations and create their own mathematical models. In addition we also see how well-prepared students are to such problems in their life. In open-ended problem situations, MEAs allow students to produce different solutions using cognitive and meta-cognitive skills, develop collaborative skills as they are applied to groups, and helps to establish interdisciplinary relationships. On the other hand, when mathematics literacy on PISA-2015 exam results is examined, the proportion of students who are at level 5 and above (upper level of competence) decreases according to PISA 2012. The percentage of students who are at high level (5. and 6. level) in PISA 2015 is 10,7% in OECD, 8,2% in all countries and 2,01% in Turkey. In order to correct this situation and reach the targeted success, we must introduce the students to modeling activities from their early ages and to educate them as individuals with high-level thinking skills. Therefore, the aim of this study is to reveal the thinking processes of the first-year-middle school students with the help of modeling activities and to identify the difficulties they face in the process. This qualitative research was conducted during the 2016-2017 academic year, in a middle school in a large city along the Black Sea Region of Turkey. Participants were the first-year students in a state school. Researchers were involved in classroom observations by participating in mathematics courses of the first-year students who did not have modeling experience before and were constantly interacting with them. After that three students among them were selected as a focus group using criterion sampling technique. They then were given the TAXI PROBLEM and asked to work on this problem. They were video-taped while they were working on the problem. Mathematical thoughts and written responses of the students were analyzed using descriptive analysis method. The preliminary findings of the study showed that students tried to transfer the problem to everyday life during the course of the activity, in that way they generated ideas, tested the solutions they have found and paid attention to the generalization of the model they elicited. On the other hand, the students had difficulty to understand the problem at the beginning of the process.

**Keywords:** Mathematical Modeling, Model Eliciting Activities, Secondary School Students



## GEMS AND ITS REFLECTIONS TO GEOGRAPHY TEACHING

*Ayşegül Şeyihoğlu*

This research was conducted to determine the opinions of geography teacher candidates for GEMS (Great Explorations in Math and Science) based learning activities based on interdisciplinary approach in Geography teaching. In this research carried out by the qualitative research approach, the case study was used. The research was carried out within the scope of "Special Teaching Methods". Firstly, the researchers introduced original GEMS-based activities to teacher candidates and shared different examples. Subsequently, prospective teachers were separated into groups and provided their own GEMS to guide their researchers. At the end of the process, the exhibits were provided by introducing the GEMS of the groups. GEMS-based teaching activities development processes and products were evaluated by the teacher candidates filling the "Group Study Evaluation Form" developed by the researcher. These forms were subjected to content analysis and findings were obtained.

**Keywords:** Geography Teaching, Gems Based Learning, Preservice-teacher



## GENDERED MATHEMATICS CLASSROOMS IN NIGERIA PRIMARY SCHOOLS IN THE 21ST CENTURY

*Zinyahs, Maris Zakka, Farhad Balash*

Gender bias in mathematics classrooms can influence male and female learners' development of attitude and values. The purpose of this research study is to examine the extent of gender bias manifestations in mathematics classrooms of grades five and six in Nigeria based on teacher-student interactions and mathematics textbooks. Documentations and observations were used to determine the extent of gender bias in mathematics classrooms. Interviews questions developed to perceived views of teacher about gender bias manifestation in mathematics classrooms based on teacher-student interactions and mathematics textbooks which they are using. The findings revealed that female and male teachers directed interaction more towards males than female students in mathematics classroom in terms of praise, acceptance and remediation. The results further show that, there is significant difference between male and female characters in the mathematics textbooks, and also there is significant difference between male and female characters on traditional occupations in mathematics textbooks. The paper consider the implication of these findings for pre-service and in-career teacher education.

**Keywords:** Gender Bias, Teacher-student Interactions, Mathematics Textbooks And Gender Stereotypes



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**Keywords:** Gender Bias, Teacher-student Interactions, Mathematics Textbooks



## GENERATION STUDY OF PISA MATHS PROFICIENCY LEVELS IN TURKISH 6TH GRADE STUDENTS

*Tahsin Oğuz Başokçu, Simgce Ceylan*

PISA is an international exam which aims to assess whether 15-year-old students are able to convert their academic outcomes into solving daily life issues as well as analyzing high level cognitive skills. PISA evaluates the outcomes through item-based skills classification constituted of IRT technique with the help of the samples gathered from each participant country. Skill classification is a grouping process which helps to interpret the proficiency of students at different points in accordance with the ranges described for each level. For the Math proficiency level of classes gathered by this process increasing from 1 to 6 hierarchically; the ability to give the correct answer at Level 1 only when all related information is presented and questions are clearly explained is recognized, whereas it is more frequent to recognize the correct answer at Level 6 in which high level cognitive skills are used, necessary knowledge is organized and interpreted to solve the problem. Of all the OECD countries, 15.8% of China and 10% of Japan are at Level 1, which is 52% for Turkey. An experimental study is being pursued in an attempt to enhance the Maths literacy success of 6th grades by increasing the number of implementations in large-scale international exams with Tubitak Research Project numbered 115K531. About 3200 students are implemented within the project as a longitudinal study. The equivalence of the tests to that of PISA has been assured. At this point, the study aims to determine whether the classifications made for PISA Turkey similarly range also in the younger age group, as well as aiming to find out whether the origin of the distinction between Turkey and other OECD countries in the higher levels begins at an earlier age.

In Izmir province, 6th grade students who were determined randomly by the stratification method were subjected to tests that required multiple levels of thinking and represented 6th grade Maths subjects such as multiple choice, true-false and open-ended. Plausible scores appropriate for PISA procedures and the cut points determined by using those scores and PISA standards were designated and Proficiency levels were reached. The proficiency levels of 6th grade students in the sample were specified with the help of this method. When the results of the study are analyzed in detail, it is clearly seen that the percentages described in the PISA 2015 Report show a similar distribution across the classroom.

**Keywords:** Pisa, Maths Proficiency Levels, Irt



## GUIDELINES FOR TRAINING OF PRACTICAL SKILLS IN MEDICINE

*Volodymyr Sulyma, Olena Sulima*

Active techniques in the course of training of students on clinical departments, in particularly, are used by teachers on a practical training on such subject matters, as: "Proctology" and "Rheumatology", where future doctors used creative situational tasks, enter dialogue with the teachers on occupations through

system of questions as teacher to the student, and the student to the teacher that allows to turn the one who studies in "subject" of process of training. It is required to notice that practical occupation is a form of educational occupation where the teacher to carry out realization of detailed consideration by students of separate theoretical provisions of a concrete subject matter, and also forms ability and skills of their practical appendix by individual performance by the student of the corresponding prepared tasks.

Besides, practical occupation in the course of training of the student is considered in department as his concrete intellectual activity irrespective of the contents and subject of a situational task as any its decision demands from future doctor of application acquired theoretical to a creativity basis in performance of practical work.

**Keywords:** Guidelines, Practical Skills, Medicine



## HIGH SCHOOL STUDENTS' ARGUMENTATION PROCESS IN PROBABILITY

*Esra Demiry*

The purpose of this study is to investigate high school students' argumentation process in probability questions regarding misconceptions. The review of the related literature presented that probability is a concept in which students at different levels have misconceptions (Fischbein & Schnarch, 1997; Konold, 1991; Mut, 2003; Tversky & Kahneman, 1974). To investigate students' reasoning regarding misconceptions of probability in detail, their argumentation process was focused in the present study.

The participants were determined as 17 students in the 12th grade of a public high school in the Marmara Region by convenience sampling. To collect data, probability questions in the study of Fischbein and Schnarch (1997) were adapted and 7 questions were prepared. Moreover, each question was related to a particular probability misconception which are representativeness, negative and positive recency effects, simple and compound events, the conjunction fallacy, the effect of sample size, availability and the time axis fallacy. Pilot study was conducted with one group involving 3 students and questions were revised. In data collection, among 17 students, four groups with two students and three groups with three students were formed for interviews. The instrument was given to students and they are asked to solve the questions by discussing and thinking aloud. In data analysis, Toulmin's model (1958, 2003) was used. In more detail, students' claims, data, warrants, backings, qualifiers, and rebuttals were identified and then argumentation diagrams of them were created. The results of the study showed that students' argumentation diagrams generally involve data, warrant and claim in the questions in which all members of the group answered correctly. However, when at least one member of the group has the misconception related to the question, their argumentation diagrams generally involve qualifier, rebuttal and backing.

**Keywords:** Probability, Misconception, Argumentation



## HOW DO SCHOOL RELATED VARIABLES EXPLAIN TURKISH STUDENTS' SCIENCE LITERACY? A HIERARCHICAL ANALYSIS USING PISA 2015 DATA

*Ertuğrul Özdemir, Mustafa Cansiz, Nurcan Cansiz, Ulaş Üstün*

In this study, we aim to examine the relationship between Turkish students' science literacy and school-related variables in PISA 2015 as a part of an extensive research project funded by Artvin Çoruh University. PISA is implemented by OECD in a cycle of three years to collect information about science, mathematics and reading literacy of 15-year-old students in participating countries. In 2015, PISA was implemented to 5895 students in 187 schools in Turkey selected through stratified-random sampling. This nested nature of the data violates the independence of observation assumption, which should be met in many statistical analyses. We use hierarchical linear modeling (HLM) since students are nested in the schools in this

sample. HLM is a statistical technique yielding a linear model for an outcome variable and a series of multilevel predictor variables. In this study, the outcome variable was fixed as students' science literacy scores while the predictor variables were selected from school-level data in PISA 2015. We started with all indices derived from various school-level predictors in the initial model. The final model involves five of them, which are statistically significant in the initial model: "science specific resources", "proportion of science teachers by all teachers", "proportion of available computers that are connected to the Internet", "total number of science teachers at school", and "creative extra-curricular activities". The final model explains 30.6% of the variance in students' science literacy scores. In conclusion, the improvements in quality and quantity of science-related teaching/learning aids, increasing the number of Internet-connected computers which are available to the students, implementing more creative extra-curricular activities in the schools may increase Turkish students' science literacy. We will discuss the reasons why science literacy has a positive relationship with "proportion of science teachers by all teachers" and a negative relationship with "total number of science teachers at school".

**Keywords:** Pisa, Science Literacy, Hierarchical Linear Modeling, School-level Variables



## HOW DOES PRESCHOOL ATTENDANCE EXPLAIN STUDENTS' SCIENCE SELF-EFFICACY? A COMPARISON OF TURKEY, FINLAND AND SINGAPORE USING PISA 2015 DATA

*Nurcan Cansiz, Ulaş Üstün, Mustafa Cansiz, Ertuğrul Özdemir*

We investigate student and school-level factors affecting science literacy in PISA 2015 in a comprehensive project funded by Artvin Çoruh University. As a part of this project, we focus on the relationship between preschool attendance and science self-efficacy for Turkey, Finland, and Singapore in this study. We chose Finland and Singapore since they are two of the top achievers in PISA although they have different educational cultures. PISA is a triennial international assessment program on 15-year-old students' science, mathematics and reading literacies to evaluate the education systems in the participating countries. Each PISA survey focuses on one of these domains and provides a summary for the others. The major domain in PISA 2015 was science literacy. Seventy-two countries or economies, including all OECD countries, participated in PISA 2015. The sample of this study includes 5895 students in 187 schools in Turkey, 5882 students in 168 schools in Finland and 6115 students in 177 schools in Singapore. Since the students are clustered in the schools, we calculated intraclass correlation (ICC) to investigate the extent to which the nested nature of the data affects science self-efficacy scores. ICCs were found to be .022, .025, and .088 for Turkey, Finland, and Singapore respectively. These values are small enough to conclude that we can ignore the multilevel nature of the data. The relationship between preschool attendance and science self-efficacy is statistically significant for all three countries. Post-hoc analyses show that the largest difference appears to be between "students who attended preschool less than a year" and "the ones who attended two years or more". Among these countries, the effect size is the highest for Singapore and the lowest for Turkey. We will discuss the possible reasons why the relationship between preschool attendance and science self-efficacy is weaker in Turkey compared to Finland and Singapore.

**Keywords:** Pisa, Science Self-efficacy, Preschool Attendance



## HOW SIXTH AND SEVENTH GRADE STUDENTS SOLVE NON-ROUTINE PROBLEMS?

*Arda Kerküt, Perihan Dinç Artut*

The aim of this study is, to determine non-routine problem solving behaviors and strategies of the sixth and seventh grade students. Sequential explanatory design was used as a mixed method strategy in this study. Participants were 123 students (60 girls and 63 boys) of the sixth and seventh grade students from a

state school located in the south of Turkey. The students were chosen using purposive sampling technique. A problem set consisting of six non-routine problems was used as a data collection tool. The problem set was prepared by the researchers according to related literature. The problem set was examined as a pilot study to 10 students. The problem set was redesigned according to obtained feedbacks from pilot study. The problems in the problem set were chosen so that they can be solved using make a systematic list, guess and check, work backward, make a drawing and look for a pattern strategies. The problem set was examined in elective mathematics classes. Students have been given enough time for solving problems. Examination process was completed in approximately 60 minutes. Clinical interviews were made with 9 students from every grade for the purpose of determining students' non-routine problem solving strategies. Quantitative data are analyzing using descriptive statistics techniques and qualitative data are analyzing using qualitative research techniques. According to first findings of the quantitative data, make a systematic list strategy is the most using problem solving strategy among the other strategies.

**Keywords:** Problem Solving, Non-routine Problems, Problem Solving Strategies



## IDENTIFYING STUDENTS' POSSIBLE SOLUTION STRATEGIES WHILE SOLVING QUESTIONS REGARDING THE CONCEPT OF MEAN

*Didem Enisoğlu, Mine İşiksal Bostan*

The purpose of this study was to investigate solution strategies used by seventh grade students regarding the concept of mean given in bar graph representations. Participants were 233 seventh grade students from two public middle schools in Gelibolu district of Çanakkale. Data were collected via a questionnaire. Students' possible solution strategies regarding the concept of mean were identified through item based in-depth analysis. The results of the study indicated that students used two different solution strategies to solve questions regarding the concept of mean. More specifically, the study indicated that the balance model and the average formula were identified as two solution strategies to solve the questions regarding the mean concept given in bar graph representations

**Keywords:** Mean, Solution Strategies, Bar Graph Representations



## IMPACT OF THE INTERACTIVE STORYBOOK READING METHOD ON CHILDREN'S SCIENTIFIC VOCABULARY ACQUISITION

*Özlem Okyay, Adalet Kandir*

This study aims to review the impact of the interactive storybook reading method on the acquisition of scientific vocabulary by children. The study universe comprises 48-72 months children with normal development levels, in the nurseries of primary schools of the Ministry of Education, at Ankara province, during the education year 2014-2015. The study group is 52 such children chosen by random selection in the 48-72 months age group at the nurseries of primary schools. 26 children from the study group were included in the experiment group, while the remaining 26 constituted the control group. The research employed a combined pattern analyzing both quantitative and qualitative data. A "General Information Form" was employed to gather general information regarding the children and their families, in addition to the "Scientific Vocabulary Acquisition Assessment Form" employed to assess the scientific vocabulary acquisition by children. The "Teacher Observation Form", the "Teacher Interview Form" and the "Family Interview Form" employed to assess the effectiveness of the "Education Program Supported with Stories with Scientific Content". In line with the primary objective of the research, the analysis of the data led to the testing of the significance of the difference between the pretest and posttest score averages from "Scientific Vocabulary Acquisition Assessment Form", for the experiment group and the control group, using "Mann Whitney U test". Wilcoxon test was applied to test the difference between the average scores

of the experiment and control groups in the pretest and posttest, as well as the difference between the pretest, posttest, and follow-up test average scores of the experiment group. In the case of the "Teacher Observation Form", the agreement between observers was noted using the Cohen's kappa factor values. The "Family Interview Form" and "Teacher Interview Form" were, on the other hand, assessed through a content analysis. In conclusion of the study, a significant difference in favor of the experiment groups was observed with respect to average posttest scores of experiment and control groups, following the application of the Education Program Supported with Stories with Scientific Content. The comparison of the pretest-posttest score averages of the children in the experiment group revealed a significant difference in favor of the posttest. The comparison of the follow-up test and posttest score averages for the children in the experiment group did not lead to a significant difference while the comparison of the follow-up test and pretest score averages revealed a significantly high value in favor of the total for the follow-up test. The concurrence among the forms filled out by two observers with reference to the results of the observation and video analysis regarding the implementation of the "Education Program Supported with Stories with Scientific Content" by the teachers, was assessed to be good/very good concurrence. These results indicate that the study may have a fundamental impact on the scientific vocabulary acquisition by children.

**Keywords:** Preschool Education, Interactive Storybook Reading, Scientific Vocabulary Acquisition, Vocabulary



### IMPROVEMENT THE ABILITY OF PRESERVICE TEACHERS' UNDERSTANDING AND USING OF EVIDENCE-BASED INFORMATION SOURCES IN SCIENCE TEACHING

*Nail Ilhan*

Teachers' knowledge of scientific studies as well as their ability to follow and apply the information given in such studies is important for improving the quality of education. Nevertheless, a growing body of research has highlighted the unwillingness of teachers for following and benefitting from scientific studies. This study aim to assess how using of Evidence-Based Information Sources in Science Teaching (EBISST) influences the teaching practices of pre-service teachers. Qualitative methods was used in this study. The study participants in this study included 12 third year undergraduate students (pre-service teacher) undertaking the primary teaching course at the Kilis University in Turkey. The data were obtained by focus group interview and document analysis. Qualitative data were analyzed by using descriptive and content analysis methods providing for understanding and explaining qualitative data in a systematic, inductive way. The pre-service teachers in the study participants conducted teaching sessions in fourth grade science classes at primary schools governed by the Turkish Ministry of Education. Pre-service teachers applied EBISST during their teaching. The teaching sessions took place weekly for six weeks. Each pre-student teacher attended four lectures per week. The researchers and mentors met with the pre-service teachers helped them with information regarding the EBISST they needed to use in class. In this study, the pre-service teachers discussed their opinions on the applicability of EBISST. According to these opinions, the factors which positively influence attitudes towards evidence-based information sources and applying research-based teaching methods were using group work in developing and planning research-based practice, observing the positive effect of such practice on students, undertaking a scientific research methods course, and opportunity to access details of teaching activities provided in the theses.

**Keywords:** Evidence-based Information, Science Teaching, Pre-service Teacher



### IN-SERVICE MATHEMATICS TEACHERS' INTEGRATION OF ICT AS INNOVATIVE PRACTICE

*Wajeeh Daher, Nimer Baya'a, Rawan Anabousy*

The professional development school (PDS) can serve as a catalyst for the professional development of mathematics pre-service as well as in-service teachers. In the present research we describe lower-

secondary in-service mathematics teachers' development of ICT integration in their teaching. This is done through the innovation diffusion model of Rogers, which consists of five stages: knowledge of an innovation, (2) forming an attitude toward the innovation, (3) taking a decision to adopt or reject, (4) implementation of the new idea, and (5) confirmation of the decision by affirming or rejecting it. In the present research, technology integration in mathematics teaching is considered as an innovation candidate for adoption by mathematics in-service teachers, where this adoption is facilitated by a community of inquiry consisting of in-service teachers, pre-service teachers and researchers. Five in-service middle school teachers participated in the present research. We used two collecting tools: observations and semi-structured interviews to collect data about different issues related to the integration of ICT in the lessons of the participating in-service teachers. The categories of the innovation diffusion model were used to analyze the participants' adoption of ICT for their teaching. The research findings indicate that the participating teachers' beliefs regarding the benefits of ICT for mathematics teaching were positive at the beginning of the experiment as well as at its end. At the same time, teachers' knowledge and experience of ICT tools in mathematics teaching improved, which contributed positively to their adoption of these tools for their classrooms. Specifically, the research results indicate that the PDS can support the in-service mathematics teachers in their adoption of new innovations, specifically when this innovation is practiced by the pre-service teachers in the training school.

**Keywords:** In-service Mathematics Teachers, Ict, Innovative Practice, Innovation Model



## INFORMATION TECHNOLOGY USE BY SCHOOLS VS. ACADEMIC ACHIEVEMENTS AS MEASURED BY TIMMS INTERNATIONAL EXAMS

*Khalid Rabayah*

The impact of employing Information Communication Technologies (ICT) in teaching and learning on students' achievements is a hot debatable issue, since the widespread of computers. The volume of research that argue for the use of ICT at schools, is almost equivalent to the volume of research that argue against the use of these technologies. Though there is a large volume of studies reporting about the impact of ICT on education in general and students' academic performance in particular, most researchers describe case studies and scattered experiments that do not provide a global view on the issue. The international examinations Trends in international Mathematics and Science Study (TIMMS) that are performed worldwide, represents an opportunity for us to examine whether there exists any correlation between the use of computers and the students achievements. The paper will try to fill in this knowledge gap by means of analyzing the TIMMS results of the year 2011 and 2015 where 63 countries ranging from rich to poor were participated. Nearly 900,000 students sat for the exam. Data obtained from the TIMMS were statistically analyzed using the Statistical Package for the Social Sciences SPSS. The parameter indicating the ICT usage for a country was represented by the number of students per computer at schools in that country, and the students' academic performance was measured by the average students' scores in both math and science for the fourth and eighth grades. The data analysis done on the extracted data clearly indicated a significant difference for those with high computers penetrations among their schools. Regression analysis significantly indicated a positive correlation between computer to students ratio and academic performance of students in both math and science exams. The results indicated significant differences even for countries with similar socio-economic conditions.

**Keywords:** Ict Use Timms Test Students Achievements

## INTEGRATED PROGRAMS FOR SCIENCE AND MATHEMATICS: REVIEW OF RELATED LITERATURE

*Kürşat Kurt, Mustafa Pehlivan*

This study presents a review of literature on the integration of science and mathematics, focusing on the dominant trends in the related studies. In the literature review, data were obtained using the keywords "integration of science and mathematics", "integration", "integrated curriculum" in the Dergipark, National Thesis Screening Center databases. Data obtained from 15 articles published between 1995-2016 were analyzed by content analysis method. In the researches investigated, it has been determined that the methods, techniques and models developed for applying science and mathematics in an integrated manner are different from each other. Despite this disparity, research results show that science and mathematics integration programs increase student achievement. Besides this positive aspect, it has also seen the emergence of some obstacles in implementation. One of such problems is the lack of teachers' and pre-service teachers' content knowledge and pedagogical content knowledge. The other deficiency is about the fact that teachers do not have sufficient experience for delivering integration programs since their pre-service education do not provide them with the opportunity to use it. As a result; Science and mathematics integration programs increase student achievement. The results of the research are contributing program developers who want to develop science and mathematics integration program, and researchers who will work on this field.

**Keywords:** Integration Of Science And Mathematics, Integration, Integrated Curriculum.



## INTEGRATING STEM IN AN ENGINEERING DESIGN PROCESS: THE LEARNING EXPERIENCE OF RURAL SECONDARY SCHOOL STUDENTS IN AN OUTREACH CHALLENGE PROGRAM

*Nyet Moi Siew*

This research was conducted to evaluate the learning experience of Grade Ten students from two Malaysian rural secondary schools that adopted the integration of STEM in an Engineering Design Process (STEM-EDP) approach vis-à-vis an outreach challenge program. A total of 89 students undertook a ten hour program which engaged them in designing and building three different prototypes as well as answering higher order thinking questions. Data on students' learning experience were captured through teachers' field notes, and participants' responses to open-ended questions. The STEM-EDP outreach challenge program brought awareness to rural school students of their potential as problem solvers, thinkers, creators, and collaborators. Students were able to simultaneously broaden their boundaries in knowledge and competency even though they experienced difficulties in tackling challenges associated with STEM activities. Findings suggested that the STEM-EDP approach can be applied as a means for fostering creativity, problem solving skills, and thinking skills among rural secondary school students.

**Keywords:** Engineering Design Process, Higher Order Thinking, Outreach Challenge Program, Rural Schools, Stem.



## INTEGRATION OF INNOVATIVE TECHNOLOGIES TO ENGINEERING EDUCATION: 3D PRINTERS

*Yalcin Durmusoglu, Gazi Kocak*

The improvement of technology by time causes the diversity of human needs. It is very important to make these new technologies applicable in educational area. This results in improvement of education quality



and rivalry in education sector which in turn result in again quality improvement. One of the recent emerging technologies is 3D printer. While 3D printers are becoming popular in many areas, they are very promising to fulfill the engineering education. Engineering education has a theoretically dense syllabus. Especially the design courses are taught at theoretical level and they cannot find the practical outcomes. That's why the studied subjects are not understood clearly and not reaching to a concrete result. By usage of 3D printers, the students will obtain the tangible outputs which will help them to understand the subject clearly. Besides, it will help the students to improve their motivation and vision. Furthermore, the topics taught by using 2-D drawings are not clearly understood. Using 3D models of these drawings will be much more helpful to the students. Consequently, integration of 3D printers to the engineering education has a great importance.

**Keywords:** 3d Printer, Education, Innovation, Engineering, Technology



## INTERRELATIONS BETWEEN METACOGNITIVE AWARENESS AND CHEMISTRY PERCEPTIONS

*Canan Koçak Altundağ, Fatma Alkan*

Metacognition is a person's operations that he or she performs for the realization, monitoring, controlling, and organization of their cognitive processes. It is used for monitoring and organizing such cognitive processes as learning, problem solving, comprehension, and reasoning. Metacognition is an important element in raising individuals who are more aware of their own mental processes; in other words, individuals who learn more consciously. Metacognitive awareness is considered to be an important factor in helping the organization of cognitive activities and the running of learning in a planned and systematic way, and it is also a factor that carries on to success in learning. Those aware of their own mental process, those who know how to use mental processes during learning, those who are able to guide themselves can establish new strategies and as a result improve their level of academic success. Perception is to reveal individuals' beliefs and ideas in a certain way. It is important to have basic chemistry knowledge in our day, so the determination of the chemistry perceptions of students has gained importance. The relationship between metacognitive awareness and multiple variables such as academic success, problem solving and cognitive skill has been studied. The aim of this study is to examine the relationship between metacognitive awareness and chemistry perceptions. Study group consists of 1091 high school students who are enrolled at high schools in Turkey. Metacognitive awareness scale and chemistry perception questionnaire were used as a data collection tools in the study. At the end of the study, it was determined that there is a statistically meaningful relationship between high school students' metacognitive awareness and their chemistry perceptions levels. This result can be interpreted as high school students with high metacognitive awareness also having high chemistry perceptions.

**Keywords:** Metacognitive Awareness, Chemistry Perception, High School Students



## INTRODUCING ONE OF CONSTRUCTIVIST APPROACHES TO PRESERVICE PRIMARY TEACHERS: THEORY OF DIDACTIC SITUATIONS

*Mustafa Gök*

Primary school mathematics curriculum is required to be carried out in accordance with the constructivist paradigms. One of the issues that instructors will have to deal with in line with this objective is design of learning milieu. Theory of Didactical Situations (DDT) presents a theoretical framework to the instructors in the preparation of the milieu within the scope of constructivist paradigms. This study aims to introduce to the preservice primary teachers how to design the teaching of mathematical concepts to the whole class in line with DDT. To this end, preservice teachers were provided a training of 8 class hours. These trainings for

the preservice teachers included the constructivist approach, DDT and the detailed explanation of its basic arguments as well as the analysis of 2 sample practices and 2 different practices being performed in an actual classroom milieu. Then, 2 weeks time was given to preservice teachers and they were asked to design a milieu in the framework of DDT for teaching of a mathematical concept. Qualitative research methods were used in the study. The population of the study is comprised of 88 preservice teachers (two groups being of 51 and 37 people) who are studying primary teaching in a state university. The data was compiled by using activity papers changing between 2 to 10 pages designing the teaching of a mathematical concept within the framework of DDT. The data analysis was examined in terms of the elements of the milieu (problem, constraints, teacher and roles of the students etc.) designed by the preservice teachers and their proper and consistent use. As a result of the analyses of the study, it was determined that milieu designed in line with DDT offered positive indicators about the use and understanding of constructivist paradigms to preservice primary teachers.

**Keywords:** Constructivist Approach, Theory Of Didactical Situations, Milieu, Preservice Primary Teachers



## INVESTIGATING A SCIENCE TEACHER'S PEDAGOGICAL DIFFICULTIES WHILE TEACHING 7TH GRADE FORCE AND MOTION UNIT

*Burak Çaylak, Jale Çakiroğlu*

The aim of the study is to determine a science teacher's pedagogical difficulties emerging from teaching physics topics to gifted students and to investigate how the teacher overcomes the difficulties. The study was conducted in a qualitative nature with a case study containing of a science teacher and three physics topics; work and energy, basic machines, and friction force. The data was collected by using semi-structured interviews, classroom observations, and field notes. After collecting the data, content analysis was used to determine pedagogical difficulties for each data. According to the findings of the analysis, we can group the findings in four stages. (1) Gifted students need to engage in enrichment activities: The teacher should plan alternative activities owing to the fact that the gifted students can easily understand regular seventh grade science curriculum. (2) Gifted students can interrogate the concepts and topics in detail. (3) The students demonstrated the out of goals and purposes: The students tried to design an experiment which was not tested in the classroom environment because of lack of the technical materials. (4) While overcoming the alternative concepts, the teacher is subjected to difficulties: The students had some alternative concepts such as the differences of work concepts between daily life and physics, simple machines include technological devices, and while calculating of potential and kinetic energy of an object, the students considered one variable affecting each kind of energy. Overcoming the alternative concepts lead to learning difficulties for students. As results, gifted students have different characteristics in science classroom than their peers. The data obtained from classroom observation in this study is parallel with gifted students' characteristics. Each characteristic of students causes many difficulties for the teacher. In order to handle the difficulties, the teacher has developed some strategies emerging from her experience.

**Keywords:** Pedagogical Challenges, Science Teacher Of Gifted Students.



## INVESTIGATING ACHIEVEMENT LEVELS OF SIXTH GRADE STUDENTS REGARDING ORDERING INTEGERS

*Gizem Sevim Atayev, Mine İşiksal Bostan*

The aim of this study was to investigate middle school sixth grade students' achievement levels regarding ordering of integers. Participants were 262 sixth grade students from one public middle school in

Etimesgut district of Ankara. Data were collected via a questionnaire. Findings indicated that achievement levels of the participants in ordering questions were moderate.

**Keywords:** Integer, Ordering, Achievement Levels, Sixth Grade Students



## INVESTIGATING CHANGES IN THE QUALITY OF SCIENCE TEACHERS' ARGUMENTATION ABOUT EARTHQUAKE ENGINEERING

*Baki Cavlazoglu, Carol Stuessy*

The purpose of this study was to investigate changes in the quality of science teachers' argumentation before and after participation in a teacher workshop on earthquake engineering. The participants were ten high school science teachers from US high schools who elected to attend the workshop. Researchers implemented argumentation via a distributed learning approach. Based on Toulmin's argumentation model, researchers adopted a classification schema from the related literature and analyzed teachers' argumentative statements to identify differences on the number of generated argumentation statements and teachers' argumentation levels before and after the workshop. Results of analysis showed that, although the number of total argumentation statements did not change significantly, the level of argumentation did increase significantly. Based on these results, it can be concluded that argumentation intervention via distributed learning approaches in the context of earthquake engineering is useful in enhancing the quality of science teachers' argumentation.

**Keywords:** Argumentation; Teacher Development; Engineering



## INVESTIGATING ENGLISH TEACHERS' BELIEFS AND ATTITUDES TOWARDS TECHNOLOGY: ARE THEY TECH SAVVY ?

*Banu Uslu, Ece Sarigül*

In today's modern and technological world using technology is very crucial for every field of education as well as also for language learning and teaching. This present study is about the characteristics of tech savvy English teachers and aims to investigate English teachers' beliefs and attitudes towards technology use in the classrooms. As it is widely known tech savvy teachers are the teachers who know a lot about modern technology and use it in classrooms. The participants of this qualitative study are 20 primary school English teachers who work in Konya region. 10 of the English teachers work in state primary schools and 10 of the teachers work in private primary schools. A demographic form and a semi-structured interview form including 5 questions about the beliefs and attitudes of teachers towards technology prepared by the researchers have been used for gathering data for the study. The results of the study reveal that almost all of the teachers have positive attitudes towards technology and use several technological tools such as mobile phones, tablets or computers in their daily life. However, they don't always use technology for teaching of English because of several reasons such as classroom environment, students' having different levels of proficiency in using technology, lacking of resources or fear of not completing school curriculum in time. In addition to giving information about the characteristics of tech savvy teachers, all of the findings of the study will be shared with the audience during the presentation of the study.

Key words: technology, tech-savvy, teaching English

**Keywords:** Technology, Tech-savvy, Teaching English

## INVESTIGATING MIDDLE SCHOOL STUDENTS' PERCEPTIONS ABOUT SCIENCE LEARNING ENVIRONMENTS IN THE CONTEXT OF INQUIRY-BASED INSTRUCTION ON GLOBAL CLIMATE CHANGE

*Emine Adadan, Sevil Akaygun*

The purpose of the study was to investigate middle school students' perceptions about science learning environments as they experienced the inquiry-based instruction on global climate change. Such an instruction was developed and implemented as part of Project Irresistible funded by EU. It was a six-week, 12-class-hour inquiry-based instruction, including several activities on global climate change. The instruction starts with eliciting students' initial conceptions of global climate change, and then students explore and explain the signs, causes, and consequences of global climate change through predict-observe-explain type of inquiry cycles. In the final lesson, to address the aspects of responsible research and innovation around the topic of global climate change, students engage in a role-playing activity. A total of 123 middle school students from Grade 6 to 8 participated into the study. About one third of the students were male, and the two third of the students were female. A five-point likert-type constructivist learning environment survey with 20 items was used for assessing students' perceptions about science learning environment that they just experienced. The survey included five dimensions, namely personal relevance, uncertainty, critical voice, shared control, and student negotiation. Data were collected before and after the participants involved in the inquiry-based instruction on global climate change. Data were analyzed using the statistical procedures (descriptive and inferential). Based on the findings from the data, compared to their regular science learning environment, the participants perceived the current learning environment more positive in terms of negotiating their ideas with their peers and teachers as well as feeling safe for asking questions or clarification about the issues that they get confused.

**Keywords:** Middle School Students, Learning Environments, Global Climate Change, Inquiry Instruction



## INVESTIGATING TEACHING PRACTICES FOR TEACHING ALGEBRAIC EXPRESSIONS WITHIN A MULTIPLE CASE STUDY

*Dilek Girit, Didem Akyüz*

Investigating teaching practices can help to understand students' understanding since effective teaching practices support students' learning (Saxe, Gearhart, & Seltzer, 1999). Practices are defined as "core activities that could and should occur regularly in the teaching of mathematics" (Franke, Kazemi & Battey, 2007, p. 249). In this regard, proposing teaching practices might be different than describing teacher knowledge components as Charalambous (2016) stated. Thus, the aim of this study is to extract the practices by focusing on the teachers' actions in the throughout the teaching of operations with algebraic expressions. Mathematical Knowledge for Teaching (MKT) model that is a practice-based approach to the knowledge concept by Ball, Thames, and Phelps (2008), is used as framework in this study. As Wilkie (2014) indicates, the studies about teaching practice for algebra was scarce; thus this study is important for filling the void about practicing teacher algebra knowledge in classroom research. Especially, both conceptual and procedural development of the algebraic expression is essential for forming an equation and solving it (Capraro & Joffrinon, 2006). Thus, this study focuses on teaching practices of operations with algebraic expressions (addition, subtraction, and multiplication). Data were collected from two middle school mathematics teachers' instructions. The two teachers were the cases in this qualitative research and the findings were presented by compare and contrast method. The practices that are found in the study are: defining the concept of term, like term, constant term, and coefficient; using equal sign; using analogies to explain addition and subtraction; using algebra tiles; providing mathematical explanations for distributive property; and noticing students' misconceptions in operations. The results suggest that the conceptual teacher knowledge influences teaching practices positively and teacher knowledge should be used in appropriate pedagogical organization to develop teaching practices.

**Keywords:** Teaching Practice, Algebraic Expression

## INVESTIGATING THE EFFECTIVENESS OF A SKILLS-BUILDING INTERVENTION TO REDUCE STRESS AND ANXIETY AND INCREASE CONFIDENCE, FOCUS AND SUBJECTIVE WELL-BEING AMONG UNIVERSITY STUDENTS

*Mubeena Nowrung, Mo Nowrung*

This study investigates the effect of a skills-building intervention on students' stress, anxiety, confidence, focus and subjective well-being at one UK university. The need for this intervention became apparent from my experience as a student, my observations from teaching and from colleagues that a large number of students feel "stressed", "anxious", and "lack confidence", which "negatively affects their studies". This was reaffirmed by students who reported experiencing these problems. This study started as a one-off workshop to help students overcome these problems. It subsequently developed into a series of five workshops because of increasing demand from students and promising preliminary findings. 39 students attended the workshops which were experiential and reflective in nature (Kolb, 1984). The teaching was structured according to Bloom's (1956) taxonomy of educational objectives and addressed the cognitive, affective and psychomotor learning domains. Students were taught skills grounded in physiological and psychological principles. Instructional methods included a combination of didactic teaching, in-class reflection, group exercises and practising the skills in class and during breaks. Data was collected using mixed methods including self-report surveys, observations and semi-structured interviews. Our findings indicate that after the workshop, students' subjective experience of stress and anxiety decreased; they felt more confident and focused and reported enhanced subjective well-being. The workshop was most beneficial for students who had been struggling most. A number of students, on the verge of dropping out, attended the workshop as a last resort. After only one day, they turned their life around. They felt more motivated and committed to complete their studies. Triangulating the data from different sources, we identified components that enhance students' learning and benefits from these workshops, and components that hinder learning. In this talk, I will present qualitative and quantitative findings and discuss implications for student learning, retention, well-being and recommendations for future interventions.

**Keywords:** Overcoming Stress And Anxiety, Building Confidence, Increasing Focus, Subjective Well-being, University Students, Higher Education



## INVESTIGATION OF DEVELOPING SKILLS IN LEARNING COURSE WITH CREATIVE DRAMA METHOD

*Selman Tuncel, Mustafa Pehlivan, Seyit Ahmet Kiray*

The purpose of this research is to obtain student views on the use of creative drama in the teaching of granular structure unit of elementary science and technology course material. In this study, a phenomenological pattern was used. Creative drama was used at appropriate places throughout the unit. This method was applied to 6th grade students who participate in science lesson. The competencies of the students were given by frequency and percentage analysis. As well as opinions from randomly selected students are presented in quote form. As a result of the research, it has been revealed that creative drama is a way of developing creative thinking, critical thinking, communication, empathy, decision making and inquiry skills in the students who are working with the course.

**Keywords:** Creative Drama

## INVESTIGATION OF HIGH SCHOOL STUDENTS' UNDERSTANDING ABOUT ELECTROCHEMISTRY CONCEPTS

*Nuri Nakibođlu, Canan Nakibođlu*

Most of the high school students are required to study fundamental electrochemistry concepts in their classes. The subject of electrochemistry is also placed in the secondary chemistry curriculum in Turkey. The concepts of electrochemistry are accepted by the students as difficult subjects. Research studies have shown that both high school students and pre-service chemistry teachers hold misconceptions in electrochemistry. The topics of electrochemistry involves intangible concepts that cannot be accessed with direct perception. On the other hand, electrochemistry has considerable importance in much application such as batteries, corrosion and electrolysis in daily life. For this reason, it is important for the students to learn the electrochemical concepts correctly. In this study, it was investigated 12th grade high-school students' understanding of electrochemistry concepts. An 18-item multiple-choice test developed by Rahayu et al. (2011) was administered to 267 12th grade high-school students from three different high schools. The electrochemistry test is relating to five conceptual categories such as reactions occurring during electrolysis, differences between electrolytic and voltaic cells, movement of ions in voltaic cells, poles in voltaic cells, voltaic cell reactions. It was concluded that several misconceptions previously reported in the literature were held by the Turkish students. The implications for teaching and learning were provided at the end of the study.

**Keywords:** High School Students, Misconceptions, Electrochemistry



## INVESTIGATION OF INTERACTION PCK COMPONENTS OF PRE-SERVICE SCIENCE TEACHERS IN STEM LESSON PLANS

*Burak aylak, Jale akirođlu, zgöl Yılmaz Tüzün*

The aim of this study is to explore the competencies of pre-service science teachers' (PST) knowledge during designing stem based lesson plans. Especially, the study focuses on the interaction among PCK components in order to understand PSTs' designing abilities of STEM based teaching. The study context includes third year students in a science methods course. The course consists of two sections including theory and practice part. In the first part of course, the instructor introduces the STEM and two teaching assistants present a sample STEM lesson. After theory part of course, PSTs are enrolled in group work (15 groups and each group includes 2-3 persons) to design STEM lesson plan and present their microteaching in front of their peers. The study has qualitative nature and the data were collected by lesson plans. Moreover, we used content analyze technique to analyze PSTs'PCK components based on Magnusson, Krajcik, and Borko's (1999) PCK model as a conceptual framework (STO; science teaching orientation, KoC; knowledge of curriculum, KoL; knowledge of learner, KoS; knowledge of instructional strategies, and KoA; knowledge of assessment). After analyzing PCK components, the interaction PCK maps were generated based on Park and Chen's (2012) mapping approach. The results of analysis showed that majority of PSTs selected physics topics to prepare their STEM plans. Only two groups used mathematical component of STEM in their plans and using materials such as dynamometer, movable and stabile pulleys, and heavy objects was considered by PSTs as the integration of technology into STEM plans. Engineering was integrated into the lesson plans by all groups as designing a product. Moreover, PCK maps showed the common interaction of KoL-KoC, KoC-STO, KoS-STO, and KoA-STO for all groups; however, each group had different interactions ranging from eight to thirteen. Number and variation of interactions demonstrated the quality of lesson plans. As a result, designing lesson plan including inquiry skills and emphasizing all STEM aspects increased the number and variation of interactions of PCK components.

**Keywords:** Pedagogical Content Knowledge, Interaction Pck Map, Stem Based Teaching

## INVESTIGATION OF KNOWLEDGE LEVELS ABOUT GLOBAL WARMING AND GREENHOUSE EFFECT OF PRESERVICE TEACHERS

*Şafak Uluçınar Sağır, Kayhan Bozgün*

One of the necessary factors for survival on Earth is protecting of the ecological balance of the environment. Increasing population ratio and using substances that can harm the atmosphere are more faced with the problem of global warming and greenhouse effect. This research was conducted to determine how change of preservice teachers' knowledge levels related to global warming and greenhouse effect. The survey method in descriptive approach was used in the study. In the spring semester of 2015-2016 academic year, 383 preservice teachers studying in different branches of education at Amasya University Faculty of Education constitute the sample. In the collection of data, the Environmental Education Research Questionnaire prepared by the researchers was used. Expert opinion was obtained for the coverage of the questionnaire form; the reliability of the scale is calculated as 0.72. The change of conceptual knowledge levels of greenhouse effect and global warming according to branch, gender, class level, taking course related the environment was investigated. The obtained data were analyzed using SPSS, independent t test, ANOVA and Chi-square tests in the evaluation of quantitative data; In the evaluation of qualitative data, frequency and percentage were used. On the findings of the study, prospective teachers have indicated the over consumption of natural resources firstly and global warming as the secondly most important environmental problem in the world. The level of knowledge about global warming does not differ according to gender, branch and class variable in the first grade; It was found that there was no difference according to gender and class variables in the 4th grade. According to the branch variable, a significant difference was found in favor of the mathematics teacher candidates. The knowledge level of teacher candidates related to greenhouse effect significantly differed in favor of men in grade 1; There is no gender difference in grade 4; It was seen that the branch variable was significantly different in the first and fourth grades in favor of the teacher candidates in the mathematics department. There was no significant difference between the groups in terms of greenhouse effect and global warming according to the environment lesson. 8.1% of the prospective teachers were able to accurately express the definition of global warming and 5.2% of the greenhouse effect. As a result, it can be said that the knowledge levels of teacher candidates related to global warming and greenhouse effect are not in sufficient level. In order for environment education given at the undergraduate level to be more effective, the persistence of information can be achieved by applying different methods and techniques. It is proposed that the researches to be carried out will be prepared in order to solve the problems of environmental education.

**Keywords:** Global Warming, Greenhouse Effect, Preservice Teachers, Environment.



## INVESTIGATION OF PRE-SERVICE MIDDLE SCHOOL MATHEMATICS TEACHERS' SPATIAL ORIENTATION ABILITY


*Nilüfer Zeybek*

Spatial orientation ability is defined by McGee (1979) as "involve the comprehension of the arrangement of elements within a visual stimulus pattern and the aptitude to remain unconfused by the changing orientation in which a spatial configuration may be presented". This ability has an important place in mathematics education (Battista, 1990; Clements & Battista, 1992). As seen in the Principles and Standards of School Mathematics (NCTM, 2000) and objectives of the Mathematics Curriculum of 5th- 8th Grades (MoNE, 2013), spatial orientation ability should be used directly or indirectly by the students. Also, it emphasizes that the importance of this ability in the Standards for Mathematics Teacher Preparation (NCTM, 2003). Considering these points, the purpose of this study is to investigate determine the level of pre-service middle school mathematics teachers' spatial orientation ability.

In this study, cross-sectional survey design will be employed. The study will be conducted with pre-service middle school mathematics teachers (1st, 2nd ,3rd and 4th grade) of the Elementary Mathematics Teacher Education program in a state university in Ankara. The Visualization of Views Test (Guay, R. & Mc Daniels, E., 1976) and Perspective Taking/ Spatial Orientation Test (Hegarty & Waller, 2004) will be used as data collection tool. In data analysis, one-way ANOVA will be conducted. The results will have presented in conference.

**Keywords:** Pre-service Teacher, Spatial Orientation

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## INVESTIGATION OF SECONDARY SCHOOL STUDENTS' COMPETENCIES REGARDING 21ST CENTURY SKILLS AND ETHICAL USE OF IT

*Canan Koçak Altundağ, Ayşem Seda Önen, Murat Altundağ*

In current times, 21st century skills embody the skills and competencies required for lifelong learning. It becomes thus considerably important to examine the secondary school students' 21st century skills given the fact that students begin to develop cognitive, affective and socio-cultural skills as well as readiness for an effective science education in the secondary school. In this study, it is aimed to explore secondary schools' 21st century skills related to the science lesson by measuring their skills at cognitive, affective and socio-cultural domains and to identify attitudes of students towards ethical use of IT. The 21st century Skills Scale, designed by Kang, Kim, Kim and You (2012), and translated into Turkish by Karakas (2015), was used as main the data collection tool. In the study, in order to identify attitudes of students towards ethical use of IT, "IT Ethics with Real Life Case Studies Scale" which was adapted to Turkish and has been proved to be valid and reliable by Duymaz (2013) was used. According to the findings, the students were found to have high 21st century skills at the cognitive, affective and socio-cultural domains. It is detected that "IT Ethics with Real Life Case Studies" provided students to be aware of the unethical behaviors they performed in their real life, to behave in ethical way and to categorize daily events as being ethical or not. In light of the results and bearing in mind the factors that led to differences in the levels of students' 21st century skills, some suggestions were made to improve the 21st century skills and positive effects on attitudes of group towards ethical use of IT.

**Keywords:** 21st Century Skills, Information Technology (it), It Ethics With Real Life Case Studies

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## INVESTIGATION OF UNIVERSITY CHEMISTRY STUDENTS' VIEWS ABOUT FLOW DIAGRAM USAGE IN ANALYTICAL CHEMISTRY LABORATORY I

*Nuri Nakiboğlu, Fahrettin Filiz, Canan Nakiboğlu*

One of the fundamental components of undergraduate chemistry courses is the laboratory work. Analytical Chemistry Laboratory I course is one of the most important laboratory courses that contain qualitative analysis experiments. Qualitative analysis deals with the identification of cations or grouping of cations and anions present in a sample. In the laboratory, if the experiments are conducted in a meaningful way, they can provide students with opportunities to engage in a process of constructing knowledge. For this reason, several graphical organizers can be used to enhance students' conceptual and procedural understanding in the laboratory and help students organize their thinking. One of these kinds of materials is a flow diagram. A flow diagram requests students to organize and interpret information by sequencing



the stages of an event. A flow diagram can also be used to illustrate the experimental strategy and the steps to be followed in a procedure. These diagrams are suitable both in communicating the procedure that was followed, as well as the logic that was used in carrying out the analysis. Since the flow diagrams are relatively complex visual representations of a process, they are probably more suitable for older students. For this reason, usage of the flow diagrams for qualitative analysis experiments is very convenient and it would be useful to outline the problem using flow diagrams. The aim of the study is to investigate the university chemistry students' thoughts about performing the qualitative analysis experiments with flow diagram in the context of Analytical Chemistry Laboratory I course. Twenty two Analytical Chemistry Laboratory-I course students participated in the study. Two questionnaires were developed by the authors to obtain university chemistry students' views about the flow diagram usage in the experiments related to qualitative analysis. The first questionnaire was administered at the beginning of laboratory course. The flow diagram instruction was fulfilled during a semester. Course subjects included qualitative analysis of group 1, 2, 3, 4, 5 cations, various selected anions and general analyses of aforementioned ions, respectively. At the end of the course, the second questionnaire was administered to investigate the effectiveness of the flow diagrams for qualitative analysis experiments. It was found that most of the chemistry students comprehended what the flow diagram was and how they were used in the qualitative analysis experiments. Besides, most of them indicated that the flow diagrams were useful for time management and all of them suggested the usage of flow diagrams in the forthcoming Analytical Chemistry Laboratory I course.

**Keywords:** University Chemistry Students, Flow Diagram, Analytical Chemistry Laboratory

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## INVESTIGATION OF VARIOUS VARIABLES ABOUT PLANT ATTITUDES OF PRESERVICE PRESCHOOL TEACHERS

*Berat Ahi, Gülbahar Güzel, Sibel Balci*

The aim of this research is to examine the attitudes of preschool teacher candidates towards the bitches in terms of gender and class level. The research was carried out with approximately 300 pre-school teachers studying at Kastamonu University. Sampling method has been used in convenience sampling. In process of the research, the analysis of the data continues.

**Keywords:** Plant, Preservice Preschool Teacher, Attitude, Plant Attitude Scale

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## INVESTIGATION ON THE USE OF MATERIALS IN PRE-SCHOOL TEACHER CANDIDATES IN SCIENCE EDUCATION COURSE

*Meltem Duran*

This study aims to determine the preschool teacher candidates' material design views on science education course. This research has utilized qualitative research methods. In the study, qualitative data collection techniques were used semi-structured interview technique. Data collection tool used in the study was developed by the researchers. Data collection tool, the content and validity of the questions in the survey is the purpose of research/expert is determined based on whether sight. Then, will put forward recommendations based on the results of the research.

**Keywords:** Preschool Teacher Candidates, Material, Science Education

## INVESTIGATOIN STUDENTS OF MENTAL MODELS AND METAPHORS TWORDS ATOMIC CONCEPT

*Halit Kiriktaş, Sinan Eslek, Mehmet Şahin*

In this study, it is aimed to determine the structure of the mental models of the individuals in the teaching process (from the middle school to the last semester of the university), the metaphors of how the individuals have changed over the teaching process and the individuals have the concept of atom. In the study, a screening model was used from descriptive research methods. The universe of the study consisted of students who were educated in organized education institutions in Izmir; 295 middle school students (60 in the 5th grade, 97 in the 6th grade, 74 in the 7th grade, 64 in the 8th grade), 214 secondary students (65 in the 9th grade, 55 in the 10th grade) (50 for first grade, 53 for second grade, 42 for third grade, and 30 for fourth grade). Class) consists of 684 people. The survey tool developed by the researchers was used as data collection tool in the research. There are three open-ended questions to determine the structure of mental models and one open-ended question to determine the metaphors for atomic concept. The obtained qualitative data were analyzed using content analysis method. At the end of the statistical calculations based on the frequency and percentage calculations made on the data, it was determined that the individuals in the sample group had different types of metaphors for the concept of atom. Again, in the sample group, it was determined that the individuals in the middle school level constituted the atoms in a similar way to the "Dalton Atom Model", and the same situation in the secondary school students. On the other hand, prospective teachers seem to have structured the atomic concept at the level of the "Dalton atomic model" in the first grade, and the Thomson Atomic model in the second and third class. It is also determined that the vast majority of the 4th grade prospective teachers are at the level of the "Dalton and Thomson model" of the mental models they have created for the atomic concept. It has been determined that a small percentage of final grade prospective teachers have structured the atomic concept according to the "Bohr Atom Model".

**Keywords:** Atom, Mental Models, Metaphor, Science



## LBM: PERCEPTIONS HELD BY 8TH GRADERS PROSPECTIVE GEOMETRIC OPTICS STUDENTS STUDYING AT EAST JERUSALEM SCHOOLS

*Kamel Hashem, Ziad Qabaja, Mohsen Adas*

The increasingly growing number of virtual schools has encouraged new modes of teaching and learning. This paper describes part of a project about Learning-by-Modeling (LbM). Studying geometric optics is increasingly important in teaching and learning physics and many science domains. Many features of geometric optics make it difficult for students to develop deep understanding. Previous research indicates that involvement with modeling can play a powerful role in science learning and understanding. Some researchers argue with this view indicating that models and modeling do not contribute to understanding geometric optics concepts, since these increases the cognitive load on students. This study identifies students' perceptions of their learning geometric optics using interactive multimedia tools (LbM) from the perspective of structure, behavior and function (SBF). Quantitative and qualitative methods are used to report about 31 students (8th graders) that engaged in an interactive multimedia learning tools about geometric optics. Results show that LbM plays a major role in students' concept formation about geometric optics, and to consider this in developing an integrating paradigm for science teaching.

**Keywords:** Learning By Modeling, Perceptions, Physics

## LEARNING TO UNDERSTAND INCLUSION RELATIONS OF QUADRILATERALS

*Zülfıye Zeybek*

Learning to identify geometric shapes and understand inclusive properties among these shapes is prerequisite for learning more complex concepts such as spatial reasoning or deductive thinking. Despite the importance of understanding geometric shapes and inclusion relations among these shapes, it has evidenced that pre-service teachers' subject knowledge of geometry is amongst their weakest knowledge of mathematics. This study aimed to investigate pre-service mathematics teachers' (PSMT), who are going to teach middle grade mathematics (grade 5-8), understanding of inclusion relationships of quadrilaterals. A designed questionnaire was administered to 52 PSMTs at the beginning and again at the end of the semester after the PSMTs were engaged in a designed five-week geometry unit. The findings of this study demonstrated that the majority of the PSMTs struggled with identifying quadrilaterals and especially inclusion relations of quadrilaterals primarily. The majority of them held static view of quadrilaterals which inhibited their understanding of inclusion relations of quadrilaterals. However, the number of the PSMTs who understood hierarchical relationship between quadrilaterals increased through the end of the semester.

**Keywords:** Geometry, Hierarchical Thinking, Quadrilaterals, Pre-service Teachers



## LESSON PLANNING PROFILES ABOUT THE USE OF MATERIALS PREPARED BY PROSPECTIVE MATHEMATICS AND BIOLOGY TEACHERS

*Rezan Yilmaz, Munise Handan Gunes*

The studies conducted in the field of education emphasize that it is necessary to prepare learning and teaching settings, which activate students, so that meaningful and permanent learning can be obtained. This situation brings along fundamental changes in curricula. Considering the fact that it is teachers, who will actualize these changes, it is very important for prospective teachers to have adequate qualifications in terms of preparing learning and teaching settings. Within that context, Special Teaching Methods, Instructional Technology and Material Development, and other similar courses are conducted in the scope of curriculum so as to raise qualified teachers in faculties of education. In this study, it is aimed to examine the lesson plans demonstrating the materials that are planned to be used by prospective teachers during the process of teaching within the scope of 'Teaching Technologies and Material Design' course as well as the process during which the mentioned materials will be used. This qualitative study was carried out with 24 prospective mathematics and 27 prospective biology teachers. The results of the descriptive analysis, which were conducted by field experts, of the materials and plans prepared within the scope of the study suggest that the prospective teachers from both departments prefer to use models, concept maps, PowerPoint presentations, worksheets, and visuals (pictures, videos, animations, documentaries, posters, and mathematics dynamic software) as materials. The lesson plans about the prepared materials demonstrate that the prospective teachers from both departments mostly prefer to use these materials during the development phase of a lesson. Moreover, it was observed that the prospective teachers also planned to use materials at the drawing attention and starting the lesson process of the introduction phase, and at the brief-summarization and closure process of the conclusion phase of the lesson.

**Keywords:** Prospective Mathematics Teacher, Prospective Biology Teacher, Material, Lesson Plan

## MATHEMATICS EDUCATION IN BILINGUAL MANNER: COGNITIVE COSTS

*Leila Salekhova*

Bilingual education is becoming more common throughout the world. There is no doubt that bilingualism comes with important advantages. The benefit of bilingualism has been shown even to extend to basic cognitive functions, namely to an improved ability of executive control. However, educational practitioners need to be aware that bilingual learning also comes with costs. They can not expect that the information learned in one language can be retrieved in another language as well as in the language of instruction. But only little research has been done on the underlying cognitive mechanisms of learning in bi- or multilingual pedagogical settings. Despite of the obvious benefits and popularity of immersion education it is far from clear whether or not there are any risks for students who are trained in such programs. The aim of our research is to investigate the possible costs and the negative effects of math bilingual education. In particular, it is necessary to identify and investigate the extent of the cognitive costs in situations when languages of instruction and of application are different. The formulated problem is fundamental, both in national and international contexts. The above situation arises, for example in secondary schools of Russia with native (Yakut, Tatar, North Ossetian, Circassian etc.) language of instruction, in which mathematics is taught bilingually by means of Russian and native languages. The teachers are using bilingual mode of teaching mathematics due to the fact that the Unified State Exam in mathematics is compulsory for all students of the Russian Federation, and it is conducted in Russian language. The interpretive approach was used in which data was collected by the transcription of video recordings of lessons and analysis of interviews with students and teachers. The data was analyzed both qualitatively and quantitatively. Cognitive costs were investigated in the process of solving mathematical problems using two languages (Russian and Tatar) by students and pupils of schools and Universities in Tatarstan. Classification of language switching was suggested on the basis of observations of real bilingual study of mathematics in high school. All code switching were divided into 4 categories: "reformulation", "translation", "terminology", and "support". The hypothesis that the negative effects from language-switching occur in the form of a time delay and deterioration of the accuracy of the solution of math problems was confirmed.

**Keywords:** Mathematics Education, Bilingualism



## MENTAL MODELS OF PRE-SERVICE SCIENCE TEACHERS ABOUT ELECTRICAL CONDUCTIVITY OF METALS

*Meryem Görecek Baybars*

The subject of electricity is one of the main subjects included in the curriculum of all grades starting with the 3rd grade in elementary school. Although it is a concept encountered from the elementary education to university education, electricity is also a concept which is very difficult to understand for students. The purpose of this study is to explore the pre-service science teachers' mental models about "electrical conductivity of metals". The study is a descriptive study and it is carried out via case study research design. The study was carried out with first year Science Teaching students (66 students) studying at Education Faculty in Muğla Sıtkı Koçman University in the spring term of 2016-2017 academic year. The data collection tool developed by Kibble (1999) was used to detect pre-service teachers mental models related to "electrical conductivity of metals". When the students' responses to the data collection tool and their drawings were examined, it was observed that evaluation at macro and micro levels was much more suitable. While the models identified at macro level with students are resistance model, flowing waters model (straight flow arrow) and energy model, + and - electrical load model and motion of electrons model were observed at micro level.

**Keywords:** Mental Models, Conductivity, Pre-service Science Teachers

## META AND CONTENT ANALYSIS OF DISSERTATIONS RELATED TO BRAIN BASED LEARNING IN SCIENCE EDUCATION IN TURKEY

*M. Diyaddin Yaşar, Veli Batdı*

The aim of this study was to do meta and content analysis of dissertations related to brain based learning in science education in Turkey. In this way, the general trend and tendency of the brain-based learning in science education is determined and its effect on achievement and attitudes are examined. Document analysis methodology which is one of the non-interactive qualitative research design, is used in the study. The sample of the study is comprised of 21 (15 master, 6 PhD) thesis. Paper classification form (Sözbilir, Kutu & Yaşar, 2012) and Comprehensive Meta Analysis (CMA) program is used for analysis of the dissertations. The findings of this study indicated that brain based learning is a new research area in Turkey and mostly practiced in science and technology education (%66,67) at secondary level-1, rare studies practiced in biology (23,81) and physics (4,76) but there is no studies practiced in chemistry education at secondary level-2. The results indicated that studies focused on teaching are most frequent with 80.95 % such as effect on achievement (% 48,57) and attitude, aptitude etc. (%40). Regarding the research methods, quantitative approaches were the most common with 90.58 % and 76.20% quasi-experimental research method used widely. Most widely studied samples were selected from the secondary level-1 and sampling size preferred between 31-100. Commonly used data collection tools were achievement (% 26,83) and aptitude, attitude, perception and personality etc. (%35,36) tests. Meta analytic finding indicated that brain based learning had a significant and positive effect on achievement and attitude in science education. Based on the results of this study, it is suggested that brain based learning should be disseminated especially in chemistry, physics and biology. And qualitative and mixed research methodologies should be carried out besides quantitative research methods in order to obtain reliable, valid, and in-depth results.

**Keywords:** Brain Based Learning, Science Education, Meta And Content Analysis.



## MIDDLE SCHOOL STUDENTS' MATHEMATICS TEST ANXIETY

*Ismail Şan, Kevser Dulkadir*

The purpose of this study is investigating the differences in mathematics test anxiety levels of middle school students due to grade and teacher gender. Mathematics Test Anxiety Scale (MTAS) (Şan, 2014) was administered to 453 middle school students. Data was analyzed by using ANOVA and t-test to determine whether the variables differ the level, or not. Results revealed significant differences in both grade and teacher gender in mathematics test anxiety scores and some of the sub-scales.

**Keywords:** Middle School, Mathematics Test Anxiety

## MIDDLE SCHOOL TEACHERS' MATHEMATICAL KNOWLEDGE WITHIN THE PRACTICES FOR TEACHING EXPONENTS: A MULTIPLE CASE STUDY

*Dilek Girit, Fadime Ulusoy*

An exponential notation is the presentation of repeated products of the same number that has a base and a power (Van de Walle et al., 2013) and the conceptualization of exponents is crucial and necessary to learn advanced mathematical concepts in algebra such as exponential functions, logarithm, and calculus (Ellis et al., 2015). However, most students perceive exponents as a new number set and have difficulty in understanding the reasoning behind the representations of exponents (Cangelosi et al., 2013; Pitta-Pantazi et al., 2007). At this point, it is important to determine the underlying reasons of students' misunderstandings. To do this, examining mathematics teachers' mathematical knowledge in practice is important because teachers' knowledge influence students' learning of mathematical concepts (Hill, Rowan & Ball, 2005). However, little attention has been paid to teachers' practice in teaching exponents (e.g. Levenson, 2012). Hence, this study aims to understand the nature of middle school mathematics teachers' mathematical knowledge for teaching (MKT) exponents within the practices of instruction. Data were collected from two middle school mathematics teachers' instructions via a multiple case study design. Data on teachers' knowledge were analyzed with respect to teaching practices based on MKT model (Ball et al., 2008). Both teachers followed four steps when teaching exponents: (i) developing/giving the definition of exponential form, (ii) providing mathematical explanations for the power of zero, (iii) using inductive reasoning to explain the sign of the negative integers based on power (odd or even), and (iv) decreasing geometric sequence to build students' thinking on zero exponent. Additionally, Teacher B also used different practices that supported students' understanding. While teacher A could not anticipate possible misconceptions about determining the product of exponents, Teacher B analyzed the possible misconceptions and misunderstandings that arise during the instruction. Thus, she could address these misconceptions by providing mathematical explanations in order to prevent them. In selecting examples, Teacher B also chose the critical examples to take the students deep into the content. However, Teacher A used the textbook's examples without considering which was important to learn the topic. Based on these important findings, the theoretical, methodological, and practical implications are discussed by offering directions for future studies.

**Keywords:** Exponents, Mathematical Knowledge For Teaching, Teaching Practices



## MODELING EXPERINCES OF MIDDLE-SCHOOL STUDENTS: HOLIDAY PROBLEM

*Neslihan Şahin, Ali Eraslan*

Mathematics teachers have recently begun to stress the need for teaching models and modeling approaches that encompass cognitive and meta-cognitive thought processes for every level of schooling, starting from pri-mary school through to higher education. Studies conducted in elementary schools have shown that modeling activities provide students with a powerful tool to use in developing critical and high-level thinking skills, and a new and effective learning environment where existing deficiencies in conceptual knowledge are identified and new mathematical knowledge is gained. Therefore, the purpose of this study is to examine the second-year-middle school students' thinking processes while working on the Holiday Problem and identify the difficulties they face in the process, if any. This qualitative research was conducted during the 2016-2017 academic year, in a middle school in a large city along the Black Sea Region of Turkey. Participants were the second-year students in a state school. Researchers were involved in classroom observations by participating in mathematics courses of the second-year students who did not have modeling experience before and were constantly interacting with them. After that three students among them were selected as a focus group using criterion sampling technique. They then were given the

Holiday Problem and asked to work on this problem. They were video-taped while they were working on the problem. Mathematical thoughts and written responses of the students were analyzed using descriptive analysis method. The preliminary findings of the study showed students were able to successfully work on the model eliciting problem of the holiday problem by reading the table, interpreting the data, made relations between two or more parameters at the table, and eliminating cities based on the required situations. However, they particularly had difficult time to understand the problem and often get back, read and discussed the problem.

**Keywords:** Mathematical Modeling, Model Eliciting Activities, Middle School Students



## MODELING FOUR OPERATIONS ON INTEGERS: COUNTERS OR NUMBER LINE?

*Emrullah Erdem, Ömer Şahin*

The aim of this study is to examine middle school mathematics teachers' and prospective teachers' modeling of the four operations on integers with "number line" and "counters". The current study is a descriptive research because of revealing the participants' modeling skills. Participants are 89 middle school mathematics teachers working in three provinces of Turkey and 93 prospective middle school mathematics teachers (grade 3 and 4) studying in the Elementary Mathematics Teaching Program of the faculty of education of a state university. It is considered that prospective teachers have taken the necessary courses for field education. As data collection tool, "Four Operations Modeling Test on Integers" in which each of the addition, subtraction, multiplication, division operations involved one was used. As a result of the analysis, it was determined that the teachers were significantly better than prospective teachers in modeling the four operations on the integers ( $z=-4.773$ ,  $p=.000$ ). All participants' modeling were found to be significantly better on number line than counters ( $z=-5.655$ ,  $p=.000$ ). A significant difference ( $z=-6.191$ ,  $p=.000$ ) was found in prospective teachers in favor of the number line, while there was no significant difference between the teachers' modeling with counters and number line ( $z=-.707$ ,  $p=.479$ ). While there was no significant difference between prospective teachers' modeling on multiplication and division operations, they were significantly better on addition than subtraction, multiplication and division; on subtraction than multiplication and division ( $p=.000$ ). Teachers were significantly better on addition than subtraction, multiplication and division; on subtraction than multiplication and division; on multiplication than division ( $p=.000$ ).

**Keywords:** Modeling Integers, Number Line, Counters, Pre- And In-service Middle School Mathematics Teachers



## NOT STEM EDUCATION ENVIRONMENT FRIENDLY FETEMM EDUCATIONAL EVENT EXAMPLES

*Sinan Erten*

According to the US National Aeronautics and Space Administration (NASA) Goddard Space Studies Institute (GISS), it is the hottest year of 2016 since 1880. GISS Director Gavin Schmidt noted that the highest temperature was measured in 2014 and 2015 before that. Pointing out that the average temperature on a global basis has increased every month since October 2015, Schmidt has expressed the seriousness of global warming, which is the most important environmental problem. As a result of these facts, we are constantly warned and alerted by conventions, contracts and certain sanctions that we, as individuals, state managers, efficient and competent institutions or organizations, must manage their

duties on them. Scientists have been researching for years that it is unfortunately not possible to come from above environmental issues unless sustainable development based on conventional fossil fuels has been given up and sustainable development and sustainable education approach has not been the target. The aim of this work is to share the environmentally friendly FeTeMM activities developed as part of sustainable development and sustainable education through the above mentioned facts. I think a lot about the importance of this work in the days when the draft program of STEM education is being published. This means that STEM education means "think, plan, produce and sell". In this training, there is no target to protect the environment, which is the agenda of the 21st century. This is seen as a major shortcoming for sustainable education and sustainable development. This study was carried out by students who took environmental education course. The events presented here are environmentally friendly FeTeMM activities carried out in the course of environmental education courses from 2000 until today. The most important feature of these activities is the use of interdisciplinary knowledge. Students' attitudes towards the environment, information on the environment, and environmentally friendly behavior were found to increase. In addition, they have learned to use a combination of the knowledge they have learned in mathematics, technology and engineering. Apart from these, the products they are trying to put out are aimed to be environment friendly products. If students are to gain environmental awareness, environmental education activities should be held in front of the environment education courses. The use of the knowledge gained from other disciplines in these events has made it clear that every lesson will be important in life by removing the "unnecessary knowledge" misconception in the students. Such activities contribute to the students' creativity, inquiry-based learning, the development of critical thinking, and the development of collaborative work with others.

**Keywords:** Fetemm, Stem, Environment Friendly Activities, Environmental Education, Environmental Education Activities



## ON MULTIPLE INTELLIGENCE APPLICATIONS IN TURKEY EVALUATION OF TECHNOLOGY USAGE

*Erol Koçođlu, Elif Meral*

We can say that, in institutions where formal and informal education is provided in Turkey for multiple intelligence applications, the learning environments and activities aimed at the development of more than one intelligence dimension of the student at the same time are being tried to be increased by the related institutions especially within the framework of constructivist learning theory. The increase in these practices has brought some reforms in terms of teacher competence, learning environment and material in educational institutions. We can say that these regulations are mostly technology-centered regulations. We can say that the ability of the teachers to use the technology, the technological tools in the learning environments or the hardware and the materials used in the lessons meet the daily needs of the technologically influential students on the development process of multiple intelligence dimensions. In this study, it was aimed to evaluate the use of technology in education on multiple intelligence applications in the context of the views of secondary school teachers working in public schools in different regions in Turkey. The study was based on qualitative methodology and NVivo 11 program was used for analysis of data and creation of models.

**Keywords:** Multiple Intelligence, Middle School, Teacher, Technology



## OVERCOMING MISCONCEPTIONS ABOUT CHEMICAL EQUILIBRIUM: A STUDY OF PROBLEM-BASED LEARNING

*Yildizay Ayyildiz, Leman Tarhan*

In this century we live in, great importance is being given to concept teaching in chemistry, many researches into concept teaching and misconceptions are being held. One of the most significant reasons for this is that teaching approaches of today accept that lasting learning is not processional but conceptual. The researches on misconceptions show that the causes of the students' forming alternative concepts are based on some mistakes made in concept teaching. Students' misconceptions can also adversely influence subsequent learning in chemistry. Currently there is a large body of research that is directed to identify and prevent misconceptions held by students. Chemical Equilibrium is one of the most difficult concepts for high school students (grade 11) to comprehend, and seriously misunderstood by students. This research aims to determine the misconceptions of students in Chemical Equilibrium in high school chemistry courses, and prevent the formation of the identified misconceptions with problem-based learning. The research was realized in two different classes as experiment group of 22 and control group of 22 pupils. To identify misconceptions about Chemical Equilibrium, a pre-test containing 10 open-ended questions was applied, and 44 students were interviewed. Then problem-based activities were constructed to integrate the learning sequences with conceptional networks. During the development process of these activities, students' misconceptions identified were also considered. While control group was taught via traditional applications, experimental group was taught via problem-based learning. Within the scope of this subject, the following subheads were addressed: -chemical equilibrium, -equilibrium constant, and -factors affecting equilibrium. After all applications, the post-test was applied to both groups and the results obtained were compared. Analyzed data from the tests and interviews showed that problem-based learning was useful for prevention the formation of the identified misconceptions of Chemical Equilibrium.

**Keywords:** Misconception, Chemical Equilibrium, Problem-based Learning, Chemistry Education



## PERCEPTIONS OF HIGH SCHOOL STUDENTS ABOUT THEIR ENVIRONMENT OF TODAY AND FUTURE

*Gülcan Çetin, Ebru Işık*

The purpose of this study was to determine the perceptions of the high school students about their environments of today and the future. Study sample included 119 secondary school students studied in a private high school in İstanbul in the fall semester of 2011-2012 academic years. The qualitative research approach was used in the study. Data were collected by drawing-writing survey. Data were analyzed by using descriptive and content analysis techniques. Study results presented the perceptions of the students about their environment was clean and their suggestions about making difference to celan environment at future.

**Keywords:** Environment, Environmental Education, Drawing-writing Technique, Biology Education, Secondary Education

## PERCEPTIONS OF TEACHING STAFF RELATED TO TECHNOLOGICAL HARDWARE ADEQUACY OF UNIVERSITIES IN TURKEY

*Erol Koçođlu*

Universities aim to cultivate highly qualified individuals with creative thinking, discipline, and broad qualification are centers where multidimensional work is being pursued and science and technology are being developed. These institutions are dynamic, they are institutions that constantly renew themselves because of their scientific origins. It will increase the quality of the workforce in terms of graduates who have the qualification of using technological information for the field which facilitates adaptation to the conditions of the day. In this study, it was aimed to determine the perceptions of the teaching staff about the technological hardware sufficiency of the universities in Turkey. The study was a qualitative study and the data obtained were analyzed based on the content analysis.

**Keywords:** University, Technology, Hardware, Teaching Staff



## PRE-SCHOOL CHILDRENS' VIEWS WITH REGARD CONCEPTIONS ON HEAT AND TEMPERATURE

*Meltem Duran*

The aim of this study is to determine the views of the pre-school children regarding the concept of heat and temperature. In line with this aim, a study group of 30 children aged between 3-6 years of age who are attending the kindergarten in several elementary schools in Giresun province during the 2016-2017 academic year has been determined. Data from the study were collected using structured interview techniques and the data obtained were analyzed by descriptive analysis. The results of the study are in the evaluation stage.

**Keywords:** Preschool, Science, Heat-temperature Concept.



## PRE-SERVICE MIDDLE SCHOOL MATHEMATICS TEACHERS' GRAPHIC REPRESENTATIONS IN DERIVATIVE

*Esra Demiray, Mine İşiksal Bostan*

The purpose of the study is to investigate to what extent pre-service middle school mathematics teachers can interpret the graph of a function and sketch the graph of its derivative. To interpret and construct graphs are among the important components of learning the conceptual foundations of calculus concepts (Ubuş, 2007). However, literature review showed that the number of the studies related to interpretation the graph of a function and construction of its derivative graph is limited. In this study, cross-sectional survey design was employed. The participants were selected as sophomore, junior and senior pre-service middle school mathematics teachers from a state university in Ankara. Since students in Elementary Mathematics Teacher Education program take Calculus I and II in the first year of the program, freshman pre-service teachers were not included in the study. Mathematical Processing Instrument for Calculus (MPIC) which was developed by Hacıömerođlu and Chicken (2011) and translated by Hacıömerođlu, Hacıömerođlu, Bukova-Güzel and Kula (2014) was used to collect data. MPIC involves both derivative and antiderivative questions. In this study, 7 graphic tasks related to derivative were asked to pre-service

teachers. In data analysis, descriptive statistics and item-based analysis were conducted. According to the results of the study, pre-service middle school mathematics teachers' achievement levels in graphic representations were evaluated as low. If the given graph of the function is not familiar to students, they had difficulty in sketching the graph of the derivative function. Moreover, it was seen that majority of the students compute the derivative of the equation and then sketch the graph of the derivative function. Moreover, a few pre-service teachers focused on the change in the slopes of tangent lines in the given graph and then tried to sketch derivative graph.

**Keywords:** Derivative, Pre-service Middle School Mathematics Teachers



## PRE-SERVICE MIDDLE SCHOOL MATHEMATICS TEACHERS' KNOWLEDGE OF DISTRIBUTION FOR DAILY LIFE DATA

*Nadide Yilmaz, I. Elif Yetkin Özdemir*

The aim of this study is to examine pre-service middle school mathematics teachers' knowledge regarding the concept of distribution. In particular, we examined whether and how they determine the distribution of a data set when a daily life context was given. We also focused on pre-service teachers' ability to use the statistical language as they express their ideas. 63 pre-service teachers working as a group of 3 or 4 were asked to solve the tasks in Statistics and Probability course. After group work, a discussion environment was created and recorded. Findings showed that pre-service middle school teachers had some difficulties to see the distribution as a whole. When we asked them to match daily life contexts with appropriate graphs of distributions, some groups focused on certain parts of the distribution. We also found that the given context influences their decision-making process. Most groups made their decisions by taking into account the center of the distribution and the deviations from the center value. Furthermore, some groups couldn't consider probability when determining the shape of the distribution. Finally, we also observed that some pre-service middle school teachers' some explanations are not include statistical terminology, they stated daily language. It is thought that it would be useful to create discussion environments for pre-service middle school mathematics teachers' understanding the concept of distribution.

**Keywords:** Pre-service Middle School Mathematics' Teachers', Distribution, Daily Life Context



## PRE-SERVICE TEACHERS' UNDERSTANDING OF GEOMETRIC REFLECTIONS

*Murat Akarsu*

Understanding the meaning and role of reflection in geometry, as well as the difficulties and strategies that students encounter while developing an understanding of reflection as a geometric transformation is crucial for pre-service teachers (PTs) preparing to teach the concept of reflection. But even if PTs have some understanding of reflections as transformations, they may not use this knowledge in interactions with students. They also need to understand the difficulties that students encounter and strategies they employ while solving problems involving geometric reflections. To shed light on the development of PTs' understanding of reflection, this proposed research will focus on exploring how schema development occurs in the movement from motion view to mapping view and determining what factors are critical to the transition from one level of understanding to the next. To explore PTs' understanding, I will use the Action-Process-Object-Schema (APOS) theoretical perspective as the conceptual framework.

**Keywords:** Preservice Teachers, Geometric Transformations, Geometric Reflections

## PRE-SERVICE TEACHERS' METAPHORICAL PERCEPTIONS TOWARDS GEN CONCEPT

*Banu Çiçek Seyhan*

The purpose of this research is to reveal the metaphoric perception of pre-service Science teachers's gen concept in the different two universities. The study group of the research consists of 325 preservice Science teachers of Atatürk (178) and Giresun University's (147) Faculty of Education in the 2015-2016 academic year. In the research, there was an effort to answer followings: what metaphors do preservice Science teachers's have about "Gen" concept and in which conceptual categories could these metaphors be classified according to their common points. The data of the research has been collected through qualitative research method. The pattern of the research has been organized in the case of phenomenology. The data of the research has been acquired through completing the following sentence for each candidate teachers; Gen is like .....; because ..... Content analysis, one of the qualitative analysis, have been used in the analysis of the data. According to the results of research ;Giresun University in the pre-service teachers' have produced 52, Ataturk University in the pre-service teachers have produced 68 different metaphors concerning in the gen concept. These metaphors have been united under four conceptual categories in terms of their common qualities. These conceptual categories and frequencies produced by pre-service Science teachers's metaphors are as follows: Form of gene, The function of gene, Characterized in gene, Content of gene. Giresun University; Form of gene ( 6 ) , The function of gene(15), Characterized in gene(16), Content of gene( 15), Atatürk University; Form of gene ( 6 ) , The function of gene (20), Characterized in gene(29), Content of gene( 13). In addition, candidate teachers who have been studying in both departments produced common metaphors. These metaphors consist of form of gene ( grain, chain), The function of gene( code, key, sand), Characterized in gene (seed, fingerprint, atom) and Content of gene ( family, memory card, class) have been determined.

**Keywords:** Biology Education, Metaphor, The Gene, Metaphoric Thought



## PRE-SERVICE TEACHERS' VIEWS ON PLANNING AND IMPLEMENTING STEM ACTIVITIES

*Serhat Kocakaya, Ömer Ensari*

This study aims to analyze the views of pre-service physics teachers on planning and implementing STEM activities. The participators of the study were eight students from Physics Teacher Education Faculty of Yuzuncu Yil University who taking 'The Research Project in Field Education' course. As a result of their research and discussion, participators organized a science festival that included STEM activities for secondary school students. Six STEM activities were implemented to twenty secondary school students in the festival. Structured interview forms were used as data source. Data qualitatively analyzed to illustrate pre-service teachers' views on planning and implementing STEM activities. According to the findings obtained, pre-service teachers indicated that they did not have difficulty in planning and implementing STEM activities, their motivation in the process increased positively and they want to use STEM activities in their lessons when they started to teaching.

**Keywords:** Stem Activities, The Research Project In Field Education, Pre-service Teacher

## PRESERVICE MATHEMATICS TEACHERS' CONCEPTUAL KNOWLEDGE OF BINARY OPERATION

*Zeki Aksu, Alper Cihan Konyalıođlu, Ümit Kul*

Binary Operations are one of the main topics of undergraduate abstract algebra. They are also a primary topic in many fields of mathematics in addition to their applications in physics, chemistry and biology. This study aims to describe the conceptual knowledge level of mathematics teacher candidates regarding binary operations. In order to achieve this, a test consisting of open-ended and true-false questions on binary operations was administered to a total of 77 teacher candidates; 32 primary school mathematics teacher candidates, 30 high school mathematics teacher candidates and 15 seniors from the mathematics department who were receiving pedagogical formation training. The data collected was analyzed using descriptive analysis in the context of the framework developed by the researchers. The findings of the study indicate that the performance of the candidates was insufficient with regards to the underlying conceptual knowledge that the questions sought. The study indicates that teacher candidates have difficulty in forming their subject knowledge successfully and they need to structure this as soon as possible.

**Keywords:** Procedural Knowledge, Conceptual Knowledge, Pre-service Mathematics Teacher, Binary Operation



## PRESERVICE MIDDLE SCHOOL MATHEMATICS TEACHERS' CONCEPTION OF AUXILIARY ELEMENTS OF TRIANGLES

*Tuđba Uygun, Didem Akyüz*

In the literature, there have been research examining different grade levels of students' understanding of geometric shapes such as triangles, their main and auxiliary elements. For example, in Wang (2011)'s study, it was found that prospective elementary teachers could form accurate logical reasoning and explanations about main elements of shapes such as angles and edges. However, they could not effectively reason using auxiliary elements. In another study, Author (2016) and Gutierrez and Jaime (1999) focused on preservice teachers' understanding about altitudes of triangles as one of auxiliary elements of triangles. They stated that it was necessary for them to attain deep knowledge about altitudes. The researchers made suggestion to perform studies about other auxiliary elements of triangles for future research. In this respect, as the necessity of making investigations about auxiliary elements of triangles was emphasized, the current study investigated preservice middle school mathematics teachers' (PMSMT) conception of auxiliary elements of triangles. In order to achieve this, the activity sheets about definitions, constructions, and properties of auxiliary elements of triangles were designed and conducted to 23 junior PMSMT. The PMSMT had engaged in these activity sheets. Then, the data were collected through their written works and analyzed based on qualitative data analysis steps suggested by Creswell (2012). It was found that, the PMSMT could effectively define auxiliary elements of triangles. However, they had difficulty in construction, concurrence and the places of these concurrency points expect for medians.


**Keywords:** Auxiliary Elements, Conception, Triangles

## PRESERVICE MIDDLE SCHOOL MATHEMATICS TEACHERS' KNOWLEDGE ABOUT STUDENTS' MATHEMATICAL THINKING RELATED TO PERIMETER AND AREA

*Pınar Güner, Didem Akyüz*

One of the important competences that teachers need to have is knowledge of students' thinking (Doerr & English, 2004). This knowledge helps to design classroom settings that support effective instruction and students' achievement (Sowder, 2007). Particularly, teachers' knowledge of students' mathematical thinking is essential for providing meaningful mathematics lessons (Lee, 2014). Thus, having this competence is also crucial for preservice teachers who are future mathematics teachers. At this point, the purpose of the current study is to examine preservice middle school mathematics teachers' knowledge about students' mathematical thinking related to perimeter and area and determine the consistency between this knowledge and students' actual mathematical thinking. Case study, one of the qualitative research designs, was used to gain an in-depth understanding of the situation. The study was conducted with four senior preservice middle school mathematics teachers who enrolled in the program of elementary mathematics education at a public university. The data obtained through video recordings from the process of planning, teaching and reflecting on three lessons towards perimeter and area. The videos from teaching were used to identify students' mathematical thinking, difficulties, mistakes and misconceptions whereas the videos from planning and reflecting were used to describe preservice teachers' knowledge of students' mathematical thinking. The data were analyzed through content analysis method. The findings showed that students had lack of knowledge about the meanings of the concepts of perimeter and area, made mistakes related to calculation and use of measurement units. In addition to this, preservice teachers' predictions and expectations about students' mathematical thinking were very low. Finally, it was observed that there were important differences between students' thinking ways, difficulties, misconceptions and possible mistakes and preservice teachers' expectations and predictions about these issues.

**Keywords:** Knowledge Of Students' Thinking, Preservice Teachers, Perimeter And Area



## PRESERVICE MIDDLE SCHOOL MATHEMATICS TEACHERS' REASONING ON STUDENTS' KNOWLEDGE OF LEARNING STATISTICS

*Huriye Ateşcan, Tuğba Uygun*

Previous research in the literature show that students have difficulty in learning the concept of statistics (Bruno & Espinel, 2009; Monteiro & Ainley, 2007). At this point, teachers have important role. They need to have sufficient knowledge of statistics and understand their students' reasoning and knowledge of statistics to teach it in their classrooms. In this respect, it is essential for teachers to analyze and identify their students' knowledge of learning statistics including their conception of graphs, errors and misconceptions (González, Espinel, & Ainley, 2011). When the fact that teacher education programs provide opportunities about teaching profession to preservice teachers is considered, preservice middle school mathematics teachers (PMSMT) should be trained to make reasoning on students' knowledge of statistics as a concept in the secondary school mathematics curriculum. Therefore, the present study aimed to explore PMSMT's identification of secondary school students' understanding of statistics, their errors and misconceptions. In other words, the purpose of the study was to answer the question of "to what extent do PMSMT understand secondary school students' knowledge of learning statistics?". In this respect, the study was organized based on case study research design. The sample of the study was composed ten senior PMSMT. In the study, a test including open-ended questions about statistics and designed by the researchers was conducted to secondary school students in a public school in southern part of Turkey. Then, the PMSMT analyzed the students' written documents and explained their

implications about the students' understanding of statistics, errors and misconceptions. Their explanations were analyzed by qualitative data analysis techniques. The data collection and analysis process of the study is continued. The findings and conclusion will be completed and explained.

**Keywords:** Knowledge Of Learning, Preservice Middle School Mathematics Teachers, Statistics.



## PRESERVICE SCIENCE TEACHERS' AWARENESS TOWARDS THE PLACE OF SOCIO-SCIENTIFIC ISSUES IN NATIONAL SCIENCE EDUCATION CURRICULUMS

*Okan Sibiç, Mustafa Sami Topçu*

Socio-scientific issues are ill-structured, complicated, and argumentative up to date issues which have multidimensional structure by emphasizing moral and ethical dimension and having risk and benefit analysis (Ratcliffe & Grace, 2003; Sadler, 2004; Zeidler et al., 2005). Since SSI could contribute students' emotional, moral and intellectual abilities and higher order thinking skills (e.g. Dawson & Venville; 2013), with the revision of national science education curriculum, SSI has been directly included and emphasized (MONE, 2013). Therefore, the aim of this study is to examine PSTs' awareness towards the place of SSI in national science education curriculums which were published in 2005 and 2013. In this study, qualitative research method has been used. 19 3rd and 4th grade PSTs participated in the study. Semi-structured interviews which explored PSTs' awareness towards national science education curriculum and the place of SSI in those curriculums in terms of scope and units in which SSI were integrated have been conducted. The data gathered have been transcribed verbatim and analyzed. According to the analysis it was found that most of the participants were aware of the both curriculums except one of the participants. It was found that found that 13 participants expressed that SSI was not included 2005 curriculum. About 2013 curriculum, 16 of them expressed the inclusion of SSI into that curriculum. For 2005 curriculum, PSTs mostly emphasized that SSI have been taken under science-technology-society-environment (STSE) scope and shared in "Living Things and Life" unit. For 2013 curriculum, about the scope of SSI, PSTs mostly emphasized that SSI have been included STSE scope. On the other hand, still, some participants were not aware of the scope which contains SSI. Lastly, PSTs noticed about the units that SSI mostly shared in "Living Things and Life" unit which was followed with "World and Universe".

**Keywords:** Socio-scientific Issues, Pre-service Science Teachers, National Science Education Curriculums



## PRESERVICE SCIENCE TEACHERS' VIEWS TOWARDS THE CONTRIBUTIONS OF SOCIO-SCIENTIFIC ISSUES TO TEACHERS, STUDENTS, AND SOCIETY

*Mustafa Sami Topçu, Okan Sibiç*

Socio-scientific issues are ill-structured, complicated, and argumentative up to date issues which have multidimensional structure by emphasizing moral and ethical dimension and having risk and benefit analysis (Ratcliffe & Grace, 2003; Sadler, 2004; Zeidler et al., 2005). In the previous studies, it has been found that SSI might contribute students' higher order thinking abilities; emotional and intellectual development; interest and motivation towards learning and participation towards science lessons (e.g. Dawson & Venville; 2013). In this study, it was aimed to examine PSTs' views towards the contributions of SSI to teachers, students, and society because of the fact that it was thought if PSTs are aware of the possible contributions of SSI, they might be more willing to integrate such issues in their further professional lives. In accordance with this aim, qualitative research method has been used. 30 PSTs who

have been selected purposefully from two state university placed in İstanbul participated in semi-structured interviews which asked the contributions of SSI in terms of students, teachers, and society. All the audio recordings have been transcribed verbatim and analyzed. As a result, it has been found that PSTs have positive views towards the contributions of SSI. For instance, they noticed that integrating SSI into science lesson might increase self-confidence and motivation of teachers towards teaching science. In addition, SSI might contribute students' academic success, scientific literacy, scientific process skills and content knowledge, motivation and interest towards science lessons, and also the abilities to produce, develop and share the idea. PSTs noticed that today's students are tomorrow's society; therefore, the contribution of SSI to students are related with the contributions of society. Being aware of the issues from everyday life such as environmental issues, GMOs etc. were emphasized mostly as contributions of SSI to students and society.

**Keywords:** Socio-scientific Issues, Pre-service Science Teachers, Contributions



## PRESERVICE TEACHERS' METAPHORS ABOUT TECHNOLOGY

*Ahmet Oğuz Aktürk, Gürbüz Çalışkan*

The study aims to investigate preservice teachers' perceptions regarding to technology by using metaphors. The participants of the phenomenological study are determined by using convenience sampling and include 318 preservice teachers. Content analysis is used to analyze the data conducted via the sentence, "Technology is like ...; because ..." that requires preservice teachers to fill in the related blanks. Based on the content analysis, it is aimed to grouping the developed metaphors according to the common characteristics of them. The results show that preservice teachers created 129 valid metaphors related to technology concept. Preservice teachers associated 93 of the 129 metaphors with object or abstract ideas that have no mobility, 13 with humans, 17 with animals, and 6 with plants. Metaphors produced by prospective teachers are grouped under 9 conceptual categories in terms of their characteristics. As a result, teacher candidates often emphasize the emerging direction of technology while it has also been seen that participants perceives technology as a tool that provides both benefit and harm. In addition, some students view technology as a source of information and entertainment, while others perceive it as a source of evil and addiction.

**Keywords:** Preservice Teachers, Technology, Metaphor, Perception Of Technology



## PRESERVICE TEACHERS' VIEWS ABOUT ENGINEERING DESIGN BASED SCIENCE EDUCATION

*Mehtap Yildirim, Hikmet Surmeli*

As science progresses, living conditions change and develop and also change the interests and needs of new generations. In order to adapt to this change, teachers need to use teaching methods and strategies appropriate to the interests and needs of the new generation. The practices of these new teaching strategies should be given first to the preservice teachers in the education faculties and they should be trained to use these strategies. One of the applications widely used in science teaching recently is the engineering design process. These practices are compatible with the inquiry-based teaching approach and it is important that these applications are applied together in science teaching. In this study, it is aimed to carry out the design planning and practices together with the inquiry based instruction to preservice science teachers. It was also aimed to take preservice teachers' views about this teaching strategy. In this



study process, the interdisciplinary application of science, mathematics and technology fields as well as teaching the engineering design process to the preservice science teachers have been taken into consideration. The study is a case study. A total of 38 preservice science teachers in two universities, who were studying in the Science Education Department in Education Faculty, participated in this study. In the first stage, the 22-item Scientific Process Skills (SPS) test was administered as a pretest to the participants. In the second stage, in order to help preservice teachers to understand engineering design process and to learn its stages, four practices were conducted in group working under the supervision of the researchers. Secondary school science subjects appropriate for design process were identified and each one was given to a student group. Participants were required to prepare lesson plans appropriate to 5E learning cycle model and to develop a problem and a design that can be applied to the problem as a final stage. They have implemented the plans they have prepared, presented the problem they have created to other groups and offered them the opportunity to design. After the practices of all groups was over, the SPS Test was re-applied as a post-test. The SPS test, which was applied as the pre- and post-test, and the 5-question interview form of the opinions of the participants after the application were used as the data collection tools in this study. The results of SPS test showed that the SPS test scores of both university participants' were increased and a significant difference was found between pre-test and post-test scores after the application. Descriptive analysis was used for the data obtained from interview form. The results obtained from this analysis showed that, engineering design practices applied together with the 5E instruction model indicate that all of the preservice teachers were satisfied and will use these applications in their teaching profession. However, most of the preservice teachers stated that they were having trouble in producing ideas during the design process, therefore they did research to find a design idea related to the subject and they could make their own designs by taking opinions from many sources. In general they focused on their designs at each stage of design process, in this way they could learn better by increasing their attention.

**Keywords:** Inquiry Based Instruction, Engineering Design Process, Preservice Science Teachers,



## **PROBLEM POSING SKILLS TOWARDS MATHEMATICAL LITERACY: THE SAMPLE OF TEACHERS AND PRE-SERVICE TEACHERS**

*Kemal Özgen*

One of the most important aims of mathematics education given to schools is to improve students' mathematics literacy skills. In this context, it is expected that mathematics teachers and prospective teachers will have knowledge, skills and experience in mathematics literacy. In the developing students' mathematical literacy, the problems that are used in the learning-teaching process are important. In this direction, mathematics educators are expected to develop mathematical problem situations to improve and assess mathematical literacy. The purpose of this research is to examine the mathematics teachers and the prospective teacher's problem posing skills' towards mathematical literacy. The research was carried out using the case study model. The study group consists of 13 mathematics teacher candidates and 5 middle school mathematics teachers who take mathematics literacy courses in undergraduate and graduate education. Within the scope of the courses, theoretical foundations for mathematics literacy were given and applied studies were carried out. In this context, three problem posing activities were asked to assess mathematics literacy from the participants. The problems developed by the participants have been examined by means of descriptive analysis. The theoretical basis in the PISA study was accepted as the framework in data analysis. The problems developed are examined in terms of type, difficulty level, situations, mathematical processes and mathematical content. It has been observed that the problems developed in the analysis of the obtained data are open-ended problems in general. In terms of level of difficulty, the problems are mostly concentrated at level 4. According to the situations in which mathematics is used, it has been determined that professional and personal questions are more dominant.

It is seen that the problems developed are more in terms of change-relations and spaces-shapes in terms of mathematical content. The average score of the employing in terms of mathematical skills were found to be higher than the formulating and interpreting. In addition, it was determined that there was a statistically significant difference in the comparison of mathematical process scores of teacher and prospective teacher in favor of teachers in formulating and total scores. It can be said that the teachers are more successful than prospective teachers in problem posing activities about mathematical literacy.

**Keywords:** Mathematical Literacy, Teachers And Prospective Teachers, Problem

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## PROJECT BASED LEARNING ACTIVITIES INTEGRATED STEM IN SCIENCE LABORATORY

*Gamze Karaer, Ersin Karademir, Özden Tezel*

Science, Technology, Engineering and Mathematics (STEM) education is essential for the student's meaningful learning through integrating knowledge, concepts and skills appropriately. There are many research focused on effectiveness of STEM activities in science education. Studies show that problem based learning strategies, inquiry based learning strategies, project based strategies, and laboratory based strategies integrated with STEM programs enhance teamwork and cooperation, student's learning satisfaction. These strategies were used in different working groups such as senior high school students, STEM teachers, freshman engineering students, technology teachers and middle school students etc. in order to cultivate their problem solving abilities and construct their knowledge. In literature, project is described as a process which not only does help to develop investigation, problem solving and high level thinking skills using appropriate knowledge, but it also helps to reveal output freely on the real life issues. Furthermore, laboratory provides a central and distinctive role in science education, and science educators have suggested that rich benefits in learning accrue from using laboratory activities. This study was designed to explore preschool teacher candidates' abilities/proficiencies about project based science laboratory activities integrated with STEM education. This study was carried out in science laboratory with 36 preschool teacher candidates during the eight weeks. Due to the fact that preschool classroom teaching programs include multidisciplinary teaching process such as mathematics teaching, science and technology teaching, life science teaching etc., preschool classroom candidates, who take place essential role in science teaching process, should be educated well-equipped individuals with positive attitudes and self-efficacy towards science laboratory. Thus, they can transform their scientific knowledge to next generations. In this study, preschool classroom teacher candidates designed projects using STEM integration. Classroom teacher candidates benefited from laboratory experiments to apply science format. They benefited from technology and engineering in order to design their projects' outcomes. Finally, they used mathematical computing in order for cost calculation their projects.

**Keywords:** Science Laboratory, Preschool Classroom Teacher Candidates, Project, Stem

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## PROMOTING STUDENTS' PERCEPTIONS TOWARD RESPONSIBLE RESEARCH AND INNOVATION THROUGH INQUIRY-BASED INSTRUCTION ON NANOTECHNOLOGY

*Emine Adadan, Sevil Akaygun*

The concept of Responsible Research and Innovation (RRI) has become an important aspect of research in European Commission's Science in Society Program. Within the framework of IRRESISTIBLE Project, an inquiry-based module involving nanotechnology applications in health sciences was developed in

cooperation with science educators, a scientist, and science teachers. In the module, the concept of RRI was introduced to the students around the main scenario of the antibacterial effect of silver nanoparticles. Students first explored the basic ideas relevant to nanoscience (e.g., size and scale, properties of matter), as well as testing and explaining the antibacterial effect of silver nanoparticles. Students then learned about the properties of other nanoparticles and discussed the aspects of RRI, namely public engagement, science education, gender equality, ethics, open access, and governance (Sutcliffe, 2011), considering the benefits and risks of nanotechnology in society (e.g., using silver nanoparticles in different commercial products). In this context, the purpose of the study was to examine students' perceptions toward RRI as they were engaged in the inquiry-based instruction on nanotechnology applications in health sciences. A total of 175 students participated in the study. About one third of the students were from middle school, and the other students involved from high school. A five-point likert-type questionnaire with 12 items, namely Questionnaire to Measure Perceptions on Research and Innovation in Today's Society, was originally developed as part of the project. The questionnaire included items for all six aspects of RRI. Data were collected before and after students experienced the module. Data were analyzed using the statistical procedures (descriptive and inferential). This paper communicates the statistical results based on the data from the questionnaire by comparing and contrasting students' perceptions toward RRI from pre to posttest.

**Keywords:** Nanotechnology, Responsible Research And Innovation, Students' Perceptions

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## PROPERTIES AND EVALUATION OF MATHEMATICS ARITHMETIC OPERATION GAMES

*Ayfer Alper, Ayşe Tekin*

In the field of mathematics there are games with different contents and features designed to support game-based learning. In this study, after introducing 17 games that deal with arithmetic operations at the level of K-12 in Mathematics, they were examined depending on 11 different criteria.

**Keywords:** Mathematics Game Based Learning, Arithmetic Operation Games

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## PROSPECTIVE MATHEMATICS TEACHERS' MAKING SENSE OF THE DECIMAL REPRESENTATION OF REAL NUMBERS AS RATIONAL NUMBER SEQUENCES THROUGH QUANTITATIVE REASONING

*Mervenur Belin, Gülseren Karagöz-akar*

Previous studies have revealed that students have misconceptions on numbers specifically on real numbers (Tall & Schwarzenberger, 1978; Ely, 2010). In order to eliminate the misconceptions, Voskoglou (2013) suggested that teaching should emphasize the use of multiple representations of real numbers and flexible transformations among the representations. In the current study, we conducted classroom teaching experiments (Cobb, 2000) with 19 prospective mathematics teachers in an English-medium university in Istanbul about the decimal representation of real numbers with the emphasis of quantitative reasoning (Thompson, 2011; Karagöz-Akar, 2016). The researchers thought of both the individuals' mathematical thinking and class' mathematical thinking as a group (Heinz, 2000) while developing the decimal representation of real numbers focusing on the relationship among three different representations: long division, division algorithm and the diagrams. The collected data consisted of

students' written work before-during-and after the teaching sessions and video records of the teaching sessions. The data analysis was done through line by line analysis of the transcriptions of the video records and the written artifacts. Results showed that thinking through quantities depicted in diagrams, prospective teachers were able to justify the reasoning behind the addition of comma next to the quotient and zero next to the remainder in the long division. Data also showed that, focusing on quantities depicted in diagrams, once prospective teachers related long division with multiple representations of rational numbers such as fractions, equivalent fractions and decimals through the mental actions of equal partitioning, grouping and counting, they were able to deduce that all these representations corresponded to the same number. Data further indicated that squeezing the decimal representation of real numbers, prospective teachers were able to deduce that real numbers could be represented by the limits of rational number sequences. Results might contribute to the mathematics education field by providing task sequences showing how difficulties regarding the real numbers could be eliminated via focusing on quantities. This might in turn inform both mathematics teachers and teacher educators in terms of developing the understanding of real numbers on the part of their students.

**Keywords:** Real Numbers, Quantitative Reasoning, Decimal Representation



## PROSPECTIVE SCIENCE TEACHERS' CONCEPTION RELATED TO ALTERNATIVE ASSESSMENT APPROACHES

*M. Diyaddin Yaşar, Banuçiçek Seyhan, Mürşet Çakmak*

In this study, it was aimed to investigate the understanding and competences of science teacher candidates about formative assessment approaches. Qualitative case study methodology was used in the study. Research group consisted of 17 senior students of science education. As a data collection tool, a semi-structured "Formative Assessment Perception Interview Form" was used which was developed by the researcher. The data were collected by conducting a total of ten in-depth interviews, 8 with focus groups and another 2 as face -to-face. Collected data were subjected to content analysis. Study findings revealed that perceptions and competences of prospective science teachers on formative assessment approaches are very low and not sufficient. In particular, it was found out in this study that prospective science teachers are familiar with the definition and function of formative assessment approaches (12%) at a low extent albeit; however, they are seriously deficient about for what purpose (7% competence) they will use and choose them, how to prepare such approaches (3% competence), how to interpret and score effects of the results for the learning-teaching process (2% competence). Science teacher training curricula need to be revised in a way to give prospective teachers a training and preparation in practical, long-term and real learning-teaching environments for formative assessment approaches.

**Keywords:** Alternative Assessment Approaches, Science Education, Science Teacher Training.



## PROSPECTIVE TEACHERS OF MATHEMATICS WERE ASKED TO; IS THERE A ROYAL ROAD TO MATHEMATICS?

*Yilmaz Mutlu*

Investigating prospective teachers' perceptions, attitudes and beliefs is one of the primary aims of teacher training studies. Identifying pre-service teachers' beliefs, tendencies and professional activities is also significant in terms of contributing to their professional development. The attitudes and thoughts of pre

service teachers about math education have many clues about the acts and performances that they will display while teaching math in classroom environment in the future. During the inclass interaction teachers' attitudes towards the course and the students' positive or negative attitudes teachers develop consciously or unconsciously while teaching math affect students' thoughts and attitudes towards math in their future life. In this study, math teacher candidates were asked to discuss the below dialogue that is storied between King Ptolemy and Euclid in the history of math. "King Ptolemy wants to learn geometry but he finds 'Elements' book too long and hard to read and understand. Therefore, he asks Euclid if there is a shorter path to learning geometry and "Euclid replies there is no 'royal road' to geometry." The aim of the study is to identify math teacher candidates' attitudes, thoughts and approaches towards math and math teaching through the above mentioned dialogue and 'royal road' metaphor. In this regard, in order to determine the opinions and attitudes of teacher candidates the study has been carried out with a qualitative approach. The opinions of 26 senior teacher candidates from the Department of Mathematics Education in a university located in Eastern Anatolian Region have been asked on a volunteer basis. In order to collect more valid and reliable data, the participants were announced that they did not have to write their names on the papers and their papers were not going to be graded. The data gathered from the teacher candidates were analyzed with content analysis method. According to the analysis, 18 of the participants (69%) found Euclid's attitude right, towards the king asking for help to learn geometry. They also stated that there was no 'easy', 'simple' and 'short' way of learning math; 'studying math is difficult, and takes time and effort'; and 'there is no short and royal road to math'. On the other hand, 8 of the participants (31%) expressed 'there might be a royal road for everybody', 'math information needs to be explained intelligibly', the royal road to geometry passes through using the right methods and techniques', 'math can be made concrete and associated with real life', 'there are various methods and techniques, and they should be selected according to students'. For these reasons they did not find Euclid's attitude right towards the king in the context of math teaching. The metaphor 'royal road' is one of the primary terms of this study. This term can be said to mean easy, broad and useful way. With reference to this meaning, the results obtained with the analysis of math teacher candidates' comments indicate that most of the participants do not have attitude and thought appropriate to the formation they have taken in their math courses. However with pedagogical formation it is aimed to teach math subjects effectively though the most current methods and techniques by taking individual differences into account. In other words, the aim is to find ways and methods to facilitate math learning and to remove the obstacles between math and student. Therefore, teachers try to provide students with learning experiences suitable for their level so as to realize effective learning. This is because an effective teacher knows how learning happens, how students acquire information and skills, which techniques and methods to use for effective learning, the advantages and disadvantages of these methods and techniques. In this research context, it may be said that asking for the opinions of teachers and teacher candidates about the educational situations under which they are not subject or object is an effective method of identifying their attitudes and thought about the investigated situations.

**Keywords:** Mathematics Education, Royal Road, Teachers Opinions, Teaching Methods

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## REAL TIME REPORT APPLICATION BASED ON LEARNING RECORD STORE

*Erdem Kismet, Burak Inner*

Learning management systems (LMS), mobile learning software, MOOC platforms, virtual seminars, simulations, learning activities with wearable devices, and augmented reality applications are a few of the learning environments that can emerge with the development of technology. Each learning environment records its own learning experiences in order to evaluate learning performance of the person. The experiences of individuals who have different tentative in various learning environments are tracked and recorded separately within each environment. For instance, learning management systems (LMS) can track in detail the learning experiences that individuals have performed on the LMS. But the real achievement of the individual is the resultant of experiences in all environments. Experience API is an e-learning solution that enables learning experiences to be recorded in a data repository called a Learning Record Store, one of the structures developed for learners to track and keep real-world learning experiences in different technological environments. Experience Api provides an interface for recording learning experiences in a

standard way. In this study, ADLnet's open-source "Learning Record Store" (LRS) and "Experience Api" (xAPI) have been installed in our own server. The experience of the students on the university learning management system (LMS) is recorded on LRS, which is in our server, via Experience Api. An Android mobile app has been developed to demonstrate that a learning experience from a different place than LMS might be taken. Learning experiences on LRS were recorded via the Experience API from the developed mobile application. By this study, an infrastructure that meets the standards was established in which students' learning experiences in all learning environments can be tracked and recorded. In addition to this infrastructure, a real-time reporting application based on LRS has been developed. This reporting application enables all learning experiences from different environments to be displayed on a Web site. The main purpose of the reporting application is to provide that records on the LRS are converted into a form that is applicable to data mining methods. Through these studies, it is aimed to prepare an environment that meets the standards that will enable us to determine what experience has had an impact on each students' achievement

**Keywords:** Experience Api, Learning Record Store, Learning Experience, Learning Management System, Learning Environments



## RESEARCHER NETWORK OF ICEMST CONFERENCE SERIES

*Ilker Türker, Rafet Durgut, Oğuz Findik*

Studying the network of researchers by the means of complex networks instruments provide a comprehensive view of interactions between individuals. This type of studies locates under Network Science as Co-authorship Networks. In this study, we constructed the researcher network of ICEMST conference series spanning the years from 2014 to 2016. In combination with this dataset, we also studied the researcher network of ICRES conference series dataset, which is traditionally held as joint scientific activity with the ICEMST series. The both researcher networks are studied both standalone and combined views to define the influences to each other. The list of important nodes (researchers) and links (co-authorship activities) between the authors are outlined, in combination with the network parameters that give information about the structure of the networks. We finally performed HD visualizations about the networks, including the author names and link weights.

**Keywords:** Co-authorship Networks, Complex Networks, Network Visualization



## RESOURCES USED BY LEBANESE SECONDARY PHYSICS TEACHERS' FOR TEACHING ELECTRICITY: TYPES, OBJECTIVES AND FACTORS AFFECTING THEIR SELECTION

*Bassel Chazbeck, Zalpha Ayoubi*

The purpose of this research was to study the system of resources, the objectives of usage and the factors affecting the selection and the integration of different resources by Lebanese secondary physics teachers in their teaching in general and particularly for teaching Electricity. For this aim, a qualitative approach was used where interviews and classroom observations were used as data collection tools. The research was designed as a collective case study where four teachers were purposefully selected, from 101 Physics teachers attending the annual meeting to discuss the answer key of the official exams, for in-depth investigation. At the beginning of the research, the four teachers were interviewed twice. The first was a general interview (GI) asking about the resources they use during their teaching in general and the second one was specific (SI) asking about resources they use to teach "Electricity". Teachers were also observed during their teaching of the chapter of "Generators and receivers". The number of classroom observations

ranging between eight and ten sessions for each. The results showed that the selection of available resource is content dependent. Lebanese secondary physics teachers used all types: Paper resources (PR), visual resources (VR), object resources (OR), and evoked resources (ER), of the available resources to elaborate their teaching activities. They paid a particular attention to the experimental activity using (OR) and (VR) to enhance students' understanding of physics in general and of Electricity in particular. Moreover, results showed that the virtual laboratory could be more efficient than the real lab at the level of precision, clarity and management in addition to its importance for illustration at the microscopic scale. It revealed also that the school setting, the time constraint and teachers' professional knowledge are the main factors that affect the selection and the integration of resources. Furthermore, due to lack of materials and equipment Physics teachers referred to evoked resources (ER) and related the content taught to everyday real life.

**Keywords:** Physics Teaching, Teaching Electricity, Resources, School Setting, Teachers' Professional Knowledge



## REVIEW OF STUDIES RELATED TO SCIENCE TEACHERS' ASSESSMENT LITERACY: TURKISH CASE

*Kemal Izci, Metin Şardağ*

Assessing student progress to aid learning is an essential skill that all teachers should develop to be successful within their profession. Teachers' knowledge, dispositions and practices of assessment is known as assessment literacy or assessment expertise in related literature. As educators, we need to support teachers to develop their assessment literacies because using assessment in a way to support student learning is one of the ways that improve students' successes. Thus, the study aims to review studies collected about assessment literacy in the context of science teacher education in Turkey to map current situation within the field. The study uses content analysis method located in qualitative research approach to review related literature. In order to gain related studies, ERIC, Google Scholar, and YOK (Higher Education Council of Turkey) databases were searched by using keywords such as 'Assessment literacy', 'Assessment knowledge' and 'Assessment practices'. Moreover, journal published electronically in Turkey were searched. We found 35 studies that conducted on science teachers related to their assessment literacies. The studies analyzed by using assessment literacy standards within the related literature. The findings showed that most of the studies used quantitative methods to investigate science teachers' dispositions and knowledge of assessment. The studies also mostly conducted on preservice teachers while a few studies collected on inservice teachers. While just two studies focused on assessment practices, no studies found to focus on how teachers' interpret and use assessment results to aid learning. We suggest that more studies need to conduct on teachers' assessment practices since teachers face with difficulties to transfer their knowledge of assessment into classroom practices. Furthermore, sometimes what teachers tell us is different than what they do because of personal and external factors. Thus, focusing on assessment practices lets us to support teachers in using assessment to aid science learning.

**Keywords:** Assessment Literacy, Literature Review, Science Teacher Education.



## SCIENCE IN OUR LIFE: SCIENCE WITH PHOTOGRAPHY

*Şengül S. Anagün, Burcu Anılan, Hüseyin Anılan, Nurhan Atalay, Zeynep Kiliç*

Science is a constantly changing and improving science that helps us to understand world, the events in the nature. With this science, the physical and biological world is defined, explained. Including abstract and

difficult to understand topics in this science of science can encourage students to memorize. Therefore, the science course for an effective science teaching should be organized in a way that will provide meaningful and in-depth learning of the students. Subjects and concepts should be embodied in science courses in particular when the developmental characteristics of primary school students are considered. In science courses, visuals can be used to make subjects and concepts more understandable and students learn in a meaningful way. These are the images; cartoons, pictures, posters, posters, and photographs. In this context, students can transfer what they have learned into their daily lives. The purpose of this study is to determine how primary school teacher candidates relate subjects and concepts related to science to their daily lives. In this context, it is requested that the primary school teachers take photographs of the events and situations they meet in their daily life with respect to the subjects and concepts which are mentioned in the course of Science. Qualitative research approach was utilized in the research. A document review technique was used in the research. In this research, photographs taken by primary school teacher candidates were handled as documents, 50 photographs taken by primary school candidates were used in the research. In the analysis of the data, descriptive analysis technique was used. In the preliminary analysis of the data, it has been determined that the candidates of the primary school candidates take photographs about the "Movements and Strengths", "All Creatures and Life", "Recognising Material", "Electric Vehicles in Our Lives" and their gains in the science curriculum.

**Keywords:** Life, Science, Photography, Elementary School



## SCIENCE TEACHERS AS SCENARIO DEVELOPERS FOR PROBLEM-BASED LEARNING

*Mustafa Çakir, Hakan Akçay*

The most important instructional element in problem-based learning is the Problem-based scenario. Designing problem scenarios that are used in problem-based learning not also requires a specific type of expertise but also plays an important role in achieving the planned learning outcomes set by curriculum and teachers. Generally, in PBL instruction the learning trajectory decided by students during tutorials determine their learning activities. Therefore, identifying and quantifying desirable features of problem-based scenarios are imperative. This study explores feasibility and utility of science teachers as problem-based scenario developers. Purposeful sampling procedure employed in order to recruit 16 science teachers who participated in this study. After completing a course module on PBL instruction they were asked to design and develop a problem scenarios. Scenarios were subjected to qualitative evaluation and analysis using scenario evaluation rubric. Results indicated that science teachers are a viable and competent problem-based scenario developers. Participating science teachers were able to develop quality scenarios that could be implemented in middle and high school science classes. These findings yield significant implications for science education and PBL instruction in that science teachers can be effective and viable resource as problem-based scenarios developers

**Keywords:** Pbl Instruction, Scenario Development



## SECONDARY SCIENCE TEACHERS' ASSESSMENT LITERACY: A LITERATURE REVIEW STUDY

*Kemal Izci*

Assessment is an integral part of effective teaching and constitutes one of the main competence areas teachers should possess. Therefore, in order to be successful in science education at the secondary level, there is a need for assessment literate secondary science teachers. Assessment literacy is defined as the ability to select and use appropriate assessment tools and the ability to use the assessment process and its results to support instruction, as well as knowledge of assessment required for teachers to achieve their instructional goals. In addition, in the related literature, besides of assessment literacy, understanding of



assessment and assessment expertise are used to explain teachers' understanding and practices of classroom assessment. The purpose of this study is to analyze the researches conducted in Turkey on the assessment literatures of secondary science teachers, to determine the current situation, to determine the deficiencies in this area and to present the necessary recommendations to contribute the field. For this purpose, educational journals published in Turkey, Google Scholar, ERIC and the Higher Education Council [YÖK] thesis database were scanned using the key words such as assessment literacy, assessment understanding, alternative assessment methods. The abstract of 58 researchers obtained from the first round of search was read and 14 studies related to secondary science teachers were analyzed for this study. The results show that most of the studies conducted is based on quantitative research method and survey, as a data collection tool, is mostly used to conduct related data. The majority of the studies were carried out in the field of biology and physics teacher education, and only one study focused on chemistry teachers. In the studies, it was determined that assessment literacy was studied as an instant situation and that a longitudinal study was never conducted. Nine of the studies focused on teacher candidates while five of them focused on in-service teachers. The results of the examined studies that secondary science teachers often prefer traditional assessment methods, although they have theoretical knowledge about alternative assessment methods, they cannot apply these methods for different limitations (e.g. lack of time) and need practical support for how to use different assessment methods to assess and support learning. Based on these results, it is recommended that by using longitudinal and qualitative methods, further research should focus on how teachers understand assessment process, how they can use this process to support teaching, and the causes and solutions of disagreement between theory and practice.

**Keywords:** Secondary Science Teachers, Assessment Literacy, Literature Review

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### SELF EFFICACY AS MEDIATOR BETWEEN LEARNING AND BEHAVIOUR AMONG IN-SERVICE SCIENCE TEACHERS

*Natrah Mohamad, Kamisah Osman, Jamil Ahmad*

The aim of this study is to explore the relationship between learning and behaviour among Malaysian science teachers after attending the In-Service Teachers Training Programme of Higher Order Thinking Skills (HOTS) which was mediated by their self-efficacy. The four-level model of Kirkpatrick was applied to evaluate training effectiveness at three levels, reaction, learning and behaviour based on the application of Bandura's social cognitive theory. Multiple regression analyses indicate that self-efficacy mediated the relationship between learning (Knowledge, Skills, Attitude change) and behaviour. One of the practical implications emerging from this study is the importance of promoting and encouraging teacher participation in hand-on and HOTS-oriented activities. Such activities not only develop their self-confidence, but enhance their self-efficacy when implementing teaching and learning innovations related to HOTS. In terms of modification of the four-level model, the school organiser of the HOTS Programme should also include "self-efficacy" in the evaluation process in order to improve its effectiveness.

**Keywords:** Learning, Self-efficacy, Behaviour, Higher Order Thinking Skills, Mediator

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### SEMIOTIC ANALYSIS OF QUESTIONS OF HIGHER EDUCATION TRANSITION EXAMINATION (YGS)

*Huriye Ateşcan, Tuğba Uygun*

The signs and representations are accepted as symptoms of mental activity and evidence for internal and external representations. They are considered in a broad sense, as something encompassing written as well as oral linguistic terms, mathematical symbols, gestures, etc. (Arzarello 2006; Ernest 2008; Radford

2002). Moreover, they are considered as constitutive parts of thinking. With the help of the signs and representations used by the people and the meanings of them for the people, the development of mathematical thinking can be understood beneficially. According to the report of NCTM (2000), it has been stated that the transition between different representation systems has improved the conceptual meaning and the result that the representation transformations should be supported in the students. In this respect, the tendencies of the national examinations (ÖSS, ÖSYS, YGS) which are the first rank of transition from secondary to higher education institutions were taken into consideration in the present study. The questions in these examinations were examined with respect to their representation transformations and their directions for students among types of representation transformation. In this context, with purposeful sampling technique, mathematical questions belonging to 12 exams made throughout the country from 2006 to 2017, where approximately 1.5 million students face each year, were selected. The data were analyzed by document and descriptive analysis techniques. In the study, the data obtained were analyzed after grouping questions based on semiotic representations and indexes for transformation by descriptive analysis. Semiotic representations were shown as percentages and index-to-index conversions were done directly on the graph with numbers.

**Keywords:** Questions, Semiotic Analysis, Semiotic Representation



## SOCIAL MEDIA AS A SCAFFOLDING TOOL: EXAMPLE OF FACEBOOK MATHEMATICS GROUP

*Esra Yemenli, Abdulkadir Erdoğan*

The concept of scaffolding is based on Vygotsky's concept of zone of proximal development. It is an instructional support provided by an adult to help student reach a higher level. It aims at the students' cognitive development with a temporary and controlled support. From this point of view, it is used as a teaching strategy in teaching mathematics. Social media has potential to be a scaffolding tool thanks to its advantages of providing quick contact and snap messaging. The aim of this study is to investigate the use of social media as a scaffolding tool in teaching mathematics. In this purpose, teachers'/experts' responses to the geometry and algebra questions put by students on a social media mathematics group were analysed in order to determine their approach of scaffolding. Teachers'/experts' responses were examined through content analysis. The findings show that there are at least 3 types of responses which are pure mathematical solution of the question, mathematical solution including feedbacks on students' solutions, mathematical solution including procedural, methodological or conceptual explanations. It was found that some scaffolding strategies such as inciting student's participation and offering conceptual explanations are less frequent.

**Keywords:** Scaffolding, Social Media, Teaching Mathematics



## SOLUTION OF SIMPLE GEOMETRY QUESTIONS USING IMAGE PROCESSING TECHNIQUES ON THE ANDROID PLATFORM: SMART PHONE APPLICATION

*Meltem Kurt Pehlivanoğlu, Nevcihan Duru, Halit Gümüş*

In this study especially for elementary school students, a smart phone application developed to solve simple geometry questions by using image processing techniques on Android Platform. With this mobile application; perimeter, area and volume calculations can be done quickly so that students can be test whether their answers are correct. When previous studies have examined, it was seen that perimeter, area and volume calculations can be done by taking like the length, height and radius information from user but image processing techniques not used at this calculation process. In developed application C++

programming language is used also benefiting from OpenCV (Open Computer Vision) library and Tesseract OCR API (Tesseract Optical Character Recognition Application Programming Interface).

**Keywords:** Education, Perimeter, Area, Volume, Android, Opencv, Tesseract Ocr Api



## STEM ETHICS: ACADEMIC INTEGRITY AND ETHICAL CONCERNS OF TEACHERS'

*Başak Helvacı, Mehmet Sencer Çorlu, Gürsu Aşık, Zerrin Doğança Küçük*

Ethical concerns in STEM Education give prominence to conduct research, especially on an e-learning assisted STEM Education professional development program as a part of STEM: Integrated Teaching Project (ITP). Professional development of STEM Education requires using the internet widely because of its ideation step and fact finding process. Using the internet actively brings its opportunity for flexibility and accessibility caused to cheating. Besides, academic integrity is a well-known requirement to implement in every step of an academic work, this is also valid for lesson plans and other course materials. Therefore, the levels of academic dishonesty and ethical concerns of teachers in ITP professional development program were investigated. During the academic year, intervention program focusing on integrated teaching knowledge (ITK) had been held. 249 teachers of elementary and high schools from 21 different cities of Turkey participated to face-to-face workshops, synchronous and asynchronous conferences. Mathematics and science teachers prepared lesson plans implementing STEM education in terms of ITK and this research was conducted by using STEM: ITP data with the written permission of Assoc. Prof. M. Sencer Çorlu, the director of the project. These lesson plans were assessed by lesson plan rubrics and references sections were investigated thoroughly. As a part of the program, asynchronous videos pointing out the importance of giving references without stating any standards or providing any instruction how to give references were reached by teachers on the learning management system. It was determined that these interventions enhanced the proceeding lesson plans. Overall, submissions were classified in four main ways of plagiarism indicating severity of plagiarism. Preliminary findings show that teachers' education level, years of professional experience, gender, age, even geographic locations and cultural factors effect severity of plagiarism.

**Keywords:** Stem Education, Ethical Concerns, Academic Integrity, Professional Development, Plagiarism



## STUDENT METAPHORS OF MATHEMATICS TEACHER CANDIDATES'

*Ismail Şan, Ali Kış*

Sometimes we use too many words for an effective narration. However, instead of using so many words, an image can be used to express the message exactly. It may even be better to use a metaphor. Metaphors are generally concepts that are employed when analogy is the case. In the communication process, they cause more influence in the mind of the receiver than words and pictures. How is the concept of student in the eyes of the students who have been involved in various students during their education years, and in various classes? Moreover, the fact that these perceptions belong to teachers of the future further increases their importance. This point of view, expressed through metaphors, has the potential to lead to new insights for educational researchers. The aim of this study is to reveal the perceptions of mathematics teacher candidates for the concept of "student" through metaphors. The study group of the research is 77 students who attended İnönü University Faculty of Education Primary Education Mathematics Teaching Program and taking "Teaching Principles and Methods" course in Fall Semester of 2016-2017 education

year. Two types of questions have been used to obtain the data of the study. The first question is, "The student is like .....; because .....", the second question is "Student is similar to .....; because ..... ". Content analysis is used in the analysis and interpretation of the data. The data of the research was collected and the data analysis process is continuing. Full text writing of the research will be completed after analysis. If the proceeding is accepted for presentation, the results will be shared with the congress participants.

**Keywords:** Metaphor, Student, Teacher Candidate

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## STUDENTS' GENERATED ANIMATION AND PROBLEM SOLVING IN PHYSICS LEARNING

*Norazlilah Md. Nordin, Kamisah Osman*

Students' skills and achievement in solving Physics problem is often regarded as a benchmark to evaluate the effectiveness of problem solving (PS). However, many studies have reported that students demonstrated low level of Physics PS skills and achievement. Arguably, that problems are related to the implementation of conventional PS learning method which is limited to individual and group PS (cooperative) approach. Therefore, an innovative approach that integrated recent paradigm of PS learning; collaborative problem solving (CPS) and manipulation of students' ICT literacy by generating animation is proposed to overcome the problem. Animation is selected as a medium that can provide opportunities for team work while designing an artefact at the same time cultivate problem solving skills. In order to evaluate the effectiveness of this learning innovation, seventy samples involved in this study. The samples were divided into two groups, the treatment group: students' generated animation with CPS learning and control group: conventional PS learning strategies. The instruments used were Rubric of CPS Proficiency and Physics Problem Solving Achievement Test (PPSAT). MANOVA test were used to determine the effect of learning module in inculcating CPS skills. While ANOVA test were used to gauge the effect in improving Physics PS achievement. The findings revealed that there were significant main effect of methods on the CPS skills and Physics PS achievement between students who underwent the innovative PS learning modules with the students who underwent conventional PS learning strategies. This study concluded that the PS learning using innovative approach is effective not only in inculcating CPS skills, but also enhance the students' Physics PS achievement.

**Keywords:** Collaborative Problem Solving, Students' Generated Animation, Physics Learning, Constructionism, Ict

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## STUDENTS' OPINIONS ABOUT GROUP STUDIES IN OUT-OF-SCHOOL STEM ACTIVITIES

*Serhat Kocakaya, Nurda Ulfer*

This study aims to analyze secondary school students' opinions about group studies in out-of-school STEM activities. The study was carried out in a "STEM Science Festival" organized in Yuzuncu Yil University with participation of 20 secondary school students. Six out-of-school STEM activities were used in the science festival that implemented in five groups. Likert-type evaluation forms completed by the students at the end of each activity were used as a data source. Evaluation forms were included "Could be better", "Good" and "Very good" options. According to the findings obtained, average of all activities was "Very good" and it could be seen that out-of-school activities have positive effects on group studies.

**Keywords:** Out-of-school Stem Activities, Group Studies, Secondary School Students

## SUPPORTING PRE-SERVICE MATHEMATICS TEACHERS MAKE SENSE OF GRAPHS AND NORMAL DISTRIBUTION WITH TINKER PLOTS SOFTWARE

*Esra Balgalmış*

Mathematics teachers need to learn how to use specific technologies in mathematics education (e.g. Tinker Plots, Geometry Sketchpad, GeoGebra, Cabri 3D, Logo etc.) to support their teaching and enhance student learning. This study investigate how Tinker Plot software can be used in teaching graphs and normal distribution with active mathematical experiments and problem oriented teaching. Tinker Plot is an interactive statistics application, intended for learning and teaching statistical concepts from primary school to higher levels. In 2016-2017 fall semesters, the research was conducted with the participation of 45 students in Dynamic geometry classes for middle school mathematics majors being taught at a public university in Turkey. The course focuses on learning of geometry, algebra and statistics topics via inquiry-based teaching with attention to the quality of mathematical knowledge and educational technology needed for teaching these topics in middle schools in computer lab environment. In the content of the course two activities were presented using Tinker Plots to build graphs and normal distribution concepts to junior university students. Students observed and constructed the two activities using Tinker Plots and enrolled in discussion about the pros and cons of the activities in terms of learning statistics concepts. The data collection method was focus group interviews about the activities. The data were analyzed through qualitative data analysis methods. This study aims to contribute to the literature by investigating how students make sense about the statistical concepts with the help of Tinker Plots activity. In focus group interview students expected to clarify the kind of content-specific technologies and instructional interventions that they experienced and detailed how educational technology support them to make sense about graphs and normal distribution. Teacher training programs and professional development initiatives should integrate technology with educational aims into the courses to develop teachers' knowledge of pedagogy, content and educational technology.

**Keywords:** : Tinker Plots, Normal Distribution, Graphs, Pie Chart, Bar Graphs



## SURGERY: TEXTBOOK FOR STUDENTS OF HIGHER MEDICAL EDUCATIONAL INSTITUTIONS

*Yakiv Bereznytskyy, Volodymyr Sulyma, Olena Sulima*

At the same time, the fact is obvious that if these capabilities are not peculiar to everyone but only to some doctors, it becomes an indicator not for mass professional thinking but personal qualities of a definite person. Broad medical activity, which includes a significant amount of both patients and medical personnel, frequency of main diseases (socially significant in many respects) and requirements on rendering high quality medical care demand mass training of clinical thinking. First of all, it is demanded by the training of the diagnosis recognition process. How is the training performed now? Nowadays, the nosological principle of training dominates. A student studies one or another disease using textbooks and lectures. Thus, the student learns symptoms of the given disease in general, without relation to one or another concrete patient. Later at a lecture, a teacher presents a patient with the disease under study to the group of students, explains specific symptoms using patient's example and checks how students acquired the particular nosological form. Thereby conclusions are made about a young doctor's ability to recognize diseases and to treat patients who have the given disease. Both teachers and students are sure that a fund of knowledge about many diseases is formed in this way and the doctor will be able to do his job professionally by accumulation of this knowledge.

**Keywords:** Surgery, Textbook, Students, Higher Medical Educational Institutions

## SYNDROME PRINCIPLE OF DIAGNOSTICS – MODERN PRINCIPLE IN EDUCATION

*Olena Sulima, Volodymyr Sulyma*

Syndrome principle of diagnostics is included by recognition of illnesses, in basis of which mental processes are fixed only with the circle of pathological and illnesses which show up the unique leading syndrome, regardless of belonging to different nosology units. Beginning the inspection of patient, a doctor must actively find out the symptoms of disease. A researcher does not yet know thus, what illness is characterized by that or other symptom, because the aggregate of the same symptoms can be observed at different illnesses. In that time, only the valuable exposure of all clinical symptoms, features of their display, is given by possibility to form separate syndromes which allow recognizing and grinding a previous diagnosis. To the basic syndromes of rheumatologically and surgical diseases it is possible to take the pain of different localization, fever, icterus, motorical-evacuation violation of gastro-intestinal tract and other very important syndromes. That, syndrome - it symptoms-complex, outwardly unique for the different diseases of different organs and systems regardless of etiology and pathogenic of disease, and also from the staggered organ or system.

**Keywords:** Syndrome, Principle, Diagnostics, Education



## TEACHER CANDIDATES' OPINIONS ON USING ONLINE APPLICATIONS IN MATHEMATICS EDUCATION: EXAMPLE OF DESMOS

*Ali Özgün Özer, Ayten Erduran*

In this study, Desmos application which is actively used on mobile platforms and which is a free application is discussed. The most common technological tool available to students is mobile devices, Desmos is not limited to mobile devices, and Desmos is an application for mobile platforms and the web, which gives both students and teachers a great advantage in the use of this application. However, the use of this application is not common in our country. In this direction, it was aimed to determine the difficulties of the mathematics teacher candidates and their opinions about the application during the Desmos applications. Case study method is used in this study. Criteria sampling method is used for the selection of the candidates for mathematics teachers. This work consists of four phases. In the first stage, the application of Desmos was introduced. In the second stage class activities were carried out with teacher candidates. In the third stage, teacher candidates designed class activities in groups and activities were discussed in the class. In the fourth stage, teacher candidates were given an interview form in order to determine the opinions and then a representative of each group was selected and a focus group interview was held. In addition, researchers kept observation notes during the applications. Speech analysis was used in the analysis of focus group interviews; descriptive analysis was used in observation notes and content analysis was used in the analysis of interview forms. Mathematics teacher candidates have stated that they see Desmos application as a very useful tool in mathematics education, that the application is student-oriented and that they will use it when they are teachers. They also compared Desmos application with Geogebra, another dynamic geometry software, and saw the lack of three-dimensional drawings as a disadvantage of Desmos application. Researchers have observed that mathematics teacher candidates are interested in technology and are eager and enthusiastic about the use of technology in mathematics education. In future studies, it is possible to apply the Desmos based learning environments developed by math teacher candidates in high schools and to investigate the effects on students.

**Keywords:** Desmos, Mathematics Education, Online Applications

## TEACHER COMPETENCIES RELATED TO THE USE OF TECHNOLOGY IN HISTORY TEACHING

*Recep Dündar*

Concrete based activities and materials have an important role in meaningful and lasting learning of the students, which is the main component of the learning environment in the learning teaching process in education. The most important principle that determines the quality of these activities and materials in the learning environment is the ability of the teacher to organize activities and use materials. Especially the use of these activities and materials is becoming more important on the permanent learning of the learners, such as the history prepared on the basis of abstract acquisition and content. Nowadays, materials used in educational environments are based on technological equipment, and teachers have problems with using these materials. Based on these problems, the main purpose of this study is to determine the perceptions of history teachers working in state schools on the use of technology in the process of learning teaching. The study was a qualitative study and Nvivo11 program was used in data analysis.

**Keywords:** History, Technology, Teacher, Concretization



## TEACHER VIEWS ON PISA 2015 RESULTS

*Mustafa Hilmi Colakoglu*

In this study, online questionnaire will be applied to 9th and 10th class teachers and school principals. The questionnaire will refer to PISA 2015 exam sample questionnaire to determine the level of knowledge and awareness of teachers about the PISA examinations. So, the recommendation will be developed for the necessary measures to improve the education at high schools and raising the awareness of teachers and principals in order to achieve better results in the next examinations.

**Keywords:** PISA, Assessment



## TEACHERS' VIEWS ABOUT IMPLEMENTING AN ENGINEERING-FOCUSED THEME WITHIN AN EARLY STEM PROGRAM

*Zerrin Doğanca Küçük, Gürsu Aşık, Şefika Girgin, Mehmet Sencer Çorlu*

Emphasis of STEM education increases in almost every country. However, there is a lack of research on teachers' understanding and integration of STEM into their classes. As the grade level decreases, the need for research on teacher preparation and teacher practices about STEM education increases. In this context, this study aims to reveal and assess the views of teachers who implemented an "Early STEM" program at their classes. The program was based on the framework of Integrated Teaching Project and designed for K-4 students. The program has been implemented in 10 schools in six different cities of Turkey and two lesson-hours per week are assigned in the school curricula. The Early STEM Program includes four themes and every theme is designed with a focus of each STEM discipline (namely, science, technology, mathematics and engineering) and integration of other STEM disciplines. The sample of the study was composed of 45 preschool and classroom teachers (11 males and 34 females). An electronic survey with five open-ended questions was sent to the teachers after their implementation of the second theme of the program centered on engineering with integration of science discipline. The findings of the study revealed

that the participated teachers had positive views on the implementation of STEM at early grades. Moreover, teachers expressed their urgent need to be trained about STEM integration. Parallel with the findings from the teachers on their implementation of the first theme, the problems such as inadequacy of time, insufficient motor skills of students for product development were reported. For this engineering-focused theme, the teachers also expressed that as grade level of students decreased; students had more difficulties to construct mechanisms with the suggested materials. One of the most significant results was that integrated teaching knowledge of the teachers improved after the implementation of the second theme of the program.

**Keywords:** Stem Education, Program Development, Teachers' Views, Integrated Teaching Knowledge, Early Childhood Education, Elementary Education



## TEACHERS' AUTONOMY SUPPORT AND CLASSMATES' SUPPORT AS PREDICTORS OF STUDENTS' BASIC PSYCHOLOGICAL NEEDS IN SCIENCE

*Münevver Subaşı, Gülşen Koçak, Yasemin Taş, Sündüz Yerdelen*

This study aimed to investigate the relationship between students' perceptions of science learning environment and their basic psychological needs in science learning. The perceived science learning environment included teachers' autonomy support and classmates' support while basic psychological needs comprised of relatedness, autonomy, and competence. According to self-determination theory, meeting individuals' psychological needs is important for healthy development of individuals and it is expected that learning environments in which students are supported by their teachers and peers contributes satisfaction of these needs (Deci & Ryan, 2000). The data of the study were collected through students' self-report surveys. The participants consisted of 1018 middle school students (33.8% sixth grade, 36.4% seventh grade, and 29.8% eighth grade) who enrolled in one of 9 selected middle schools located in Erzurum, one of the largest cities in eastern part of Turkey. 52% of the participants were boys and 48% of them were girls. The average science achievement score from previous year was 4.37 (SD= 0.78) over 5. Three separate hierarchical regression analyses were conducted with each basic psychological need dependent variable. In the first step of the analysis, gender and prior science achievement were included in the model in order to control for their effects. Afterwards, in the second step, teachers' autonomy support and classmates' support were included. Results showed that, both teachers' autonomy support and classmates' support statistically significantly and positively predict all basic psychological needs components (i.e., relatedness, autonomy, and competence). Teachers' autonomy support emerged as a better predictor of basic psychological needs than classmates' support. The explained variance in the basic psychological needs components ranged from 33.4% to 40.8%. Based on the findings of the study, students' seem to feel more autonomous, related, and competent in science learning environment where science teacher provides students choices and classmates treat them nicely.

**Keywords:** Basic Psychological Needs, Teachers' Autonomy Support, Classmates' Support, Science Education



## TEACHERS' PERCEPTIONS OF TYPES OF ERRORS IN MATHEMATICS BETWEEN ARAB ORDINARY STUDENTS AND STUDENTS WITH LEARNING DISABILITIES

*Nihad Massalha*

Learning Math is considered as one of the most difficult subjects for pupils. Different types of mathematic errors appear when pupils do exercises at class or when they do their homework. The main reason of these errors is because Math requires high order cognitive skills. The primary aim of this research is revealing types of difficulties in Math that appear between Ordinary Students (OS) and Students with Learning Disabilities (SLD) in the elementary level. The sample of the research consists of 192 elementary teachers. 61 of them are teachers of special education who teach students with learning disabilities. A qualitative method was used for analyzing the Data that were collected by interviews based on half –structured questionnaire. Research results indicated the presence of various difficulties among students underlie common errors that appear in the ability of students to solve mathematic problems. These errors can be classified into two main types: First, Direct Arithmetic Errors, such as Errors In Basic Mathematic Concepts (EBMC), Errors in Implementation of Basic Arithmetic Operations ) EIBAO), Errors in Solving Verbal/Non-verbal Mathematical Questions (ESV/NMQ) wich is divided into two groups: ESV/NMQ due to difficulties in the ability to convert verbal and non-verbal terms into numbers and (ESV/NMQ) duo to difficulties in the ability to organize data and planning for solution. Second, Indirect Arithmetic Difficulties such as difficulties duo to ADHD, difficulties duo to Reading and Understanding Written Language and duo to other reasons that will be discussed furtherly in the International Conference. In addition, the results indicated a significant difference in the rate and type of errors and difficulties between Ordinary Students and Students with Learning Disabilities. Where it turns out that most of the errors among OS is due to difficulties in high-level cognitive skills, such as organizing information and planning solution, while errors among Students with Learning Disabilities were related to both Low and High-level cognitive skills. Further analysis will be presented at the conference.

**Keywords:** Teachers' Perceptions, Types Of Errors, Mathematics Difficulties, Learning Disabilities



## TEACHING HONEYBEE TO PRE SCHOOL CHILDREN THROUGH MUSEUM VISIT AND MULTIPLE INTELLIGENCES TEACHING

*Nihal Maccario*

Bees have an essential role in our ecological system, because of their contribution to health and reproduction of fruits and cultivated plants, through the pollination of flowers. It is very important for children to be aware, since early years of school, of bees lifestyle, learning their anatomy, organization, hierarchy, and, being familiar with them, to be able to win their instinctive fear. For this aim, a learning program, that included theoretical and visual approach, with the help of exhibits and living beehives, was organized in collaboration with Muğla Beekeeping Museum for pre-school children class. The program included preliminary activities as to taste honey, complete some bees puzzle, watching animations and documentaries in classroom and, after that, the attendants were brought to visit Muğla Beekeeping Museum ,where direct observations were possible, and some more explanation had been given "on the field". Again in classroom, under the teacher supervision, the children made role- plays about honey production and pollination and prepared draft showing their knowledges. Pre-test and post- test conducted with voice- recorded questionnaires, and analysis of the children draft have showed that bees-life, as anatomy, functions, hierarchy, ect. was far more familiar after this experience, as well as fear was now reduced. As an outdoor learning environment, supported by activities that stimulate multiple intelligences, it can be said that the experience in the museum have contributed to children's formation, even though the participants were in their early age of life.

**Keywords:** Early Childhood Education, Outdoor Learning, Non-formal Learning, Honeybee, Museum Education, Multiple Intelligences.



## TEACHING MATHEMATICS USING LECTURE CAPTURE TECHNOLOGY

*Diana Audi*

Technology in higher education is dramatically changing and continuously giving a challenging time for educators and institutions to provide the same level of innovative contents, environment and interaction to a digital native generation which is well powered with technology. It has been well observed and recognized that video lectures technology can have positive impacts on student learning and satisfaction however research on Mathematics intensive subjects have yet to be fully explored. This exploratory evaluation seeks to examine students' experiences and perception on receiving lectures via a digital lecture technology, and to assess using statistical tools the benefits of those video lectures on student performance in a mathematics intensive subject for freshman students at the American University of Sharjah, UAE. The concept of introducing rich text format lecture capture technology in Mathematics subjects (Math for Business and Calculus 2) was rigorously analyzed on a total sample of more than 300 students over multiple semesters. Both control groups without using any form of technology and experimental groups with using the proposed technology were compared in terms of student acceptance and academic performance improvements. Both qualitative and quantitative analysis were used and the results are very promising. Students saw the added benefits and found the technology very useful

**Keywords:** Video Lectures, Lecture Capturing, Teaching And Learning Technology, Innovative Learning Technology, Student Performance, Mathematics Teaching.



## TEACHING NANOTECHNOLOGY AS AN EXTRACURRICULAR ACTIVITY: VIEWS OF TEACHERS

*Sevil Akaygun, Emine Adadan*

As a part of IRRESISTIBLE Project (EU-FP7-SCIENCE-IN-SOCIETY-2013-612367), a module, Nano and Health, integrating Responsible Research and Innovation (RRI) to nanotechnology education through inquiry-based science education was developed. The theme of the module was introduced to the students with a scenario involving hospital-acquired infections and the role of silver nanoparticles in preventing infections. During the implementation of the module, students started with examining the basic ideas relevant to nanoscience (e.g., size and scale, properties of matter, and tools). Then, they tested and explained the antibacterial effect of silver nanoparticles and then the changing amount of silver nanoparticles in nanoproducts as they are washed. Finally, students read about the properties of other nanoparticles (e.g., gold nanoparticles) as well as discussing the aspects of RRI, namely public engagement, science education, gender equality, ethics, open access, and governance, by considering the nanotechnology in society, in particular the use of silver nanoproducts to be protected from bacterial infections. After completing the 8th lesson, they designed and developed an exhibit as a group, as well as presented their work at a science center in a local exhibition. A total of 24 teachers from 18 schools implemented the module in their schools as an extracurricular activity within 12 weeks. Eight of the teachers were teaching at middle school. At the end of the implementation, teachers were interviewed, and they filled an open-ended questionnaire reflecting on their experiences. All the responses of teachers were coded and analyzed. Based on the preliminary results, almost all teachers agreed that their students improved collaboration, critical thinking,

inquiry, and design-based learning skills even though they experienced some challenges such as lack of time, and improper physical conditions. Finally, they all recommended it to other teachers, because they believed that implementing this module improved their content and pedagogical content knowledge.

**Keywords:** Nanotechnology Education, Responsible Research And Innovation, Extracurricular Activity



## TEACHING QUADRANGLE SUBJECTS THROUGH MIND MAPPING TECHNIQUE

*Ali Ozdemir, Aysegul Alaybeyoglu, Kadriye Filiz Balbal*

Learning, which is a lifelong process, is very important, especially for students in formal education. It is important for students to learn easily, quickly, effectively and permanently. There are many different learning methods and techniques to achieve this. One of these is the mind mapping technique. The mind mapping technique, which is a visual technique in which the main element to learn is located in the center and other items spread out from the center, is an effective technique that allows even the most complex structures to be understood easily. There are studies in the literature about the use of the technique in different lessons and the determination of its effects. The purpose of the proposed study is to determine the students' views on the practice using the mind mapping technique in high school mathematics. In the study, firstly, high school 10th grade students were given information about mind mapping technique. Following this, they are asked to create their own mind maps about the quadrangle subject. At the end of the course, the mind maps they have created are examined and the opinions of the students who participated in the application are evaluated.

**Keywords:** Mind Map, Quadrangle



## TEACHING THE TOPICS OF AREA MEASUREMENT IN SIXTH GRADE STUDENTS: AN ACTION RESEARCH

*Özlem Tomooğlu, Aytaç Kurtuluş*

Area and area measurement in Geometry are very important concepts and they are among the basic geometric concepts that will help us in making sense of the environment which we live in. It is very important to grasp the character of the area before measuring the area, as it is the set of points in a two-dimensional space within a geometrically area. The most common geometric shapes in daily life are triangles and parallelogram and the curriculum includes the calculation of the area of the parallelograms and triangles at the sixth grade level. Research conducted area measurements related to previous acquisitions and issues of researchers in the field indicate that they have difficulties in teaching the subject of measurement. One of the researchers in this study was planned as a research activity investigation because at the same time it was a mathematics teacher and aimed to increase the quality of his teaching process. The working group is composed of 17 sixth grade students at Ertuğrulgazi İmam Hatip Middle School located in Alpu in Eskişehir. 11 of them are girls and 6 are boys. The first step of the action research is to determine the problem situation. Therefore, the problem of this researcher is "How to teach the area of triangles and parallelogram more effectively in sixth grade mathematics class?". A literature review on the problem was made and after data collection steps performed by determining action plans in the 5E learning model lesson plans are prepared.

Each action plan consists of four phases in itself. Outputs of the prepared and implemented action plan have been effective in forming the next plan. After the implementation step of the action plans, the rating phase has been completed.

**Keywords:** Area Measurement, Action Research, Triangle, Parallelogram



## TEACHING VECTOR OPERATIONS WITH MULTIPLE REPRESENTATIONS

*Kemal Koç, Ayhan Aksoy*

Vectors is a fundamental concept which has very important applications and is used to define several mathematical and physical concepts and quantities. By the reason of its importance in both of these disciplines, students' understanding of vectors concepts have been analyzed by many researchers in problems with a physical context and/or with a mathematical context. In this study, we implemented a pre-test with isometric mathematical and physical problems to the students who had completed the required introductory physics course at the mathematics teacher education program and engineering program of a Turkish university. It is explored and analyzed the commonly identified error patterns and students' misconceptions about vectors and vector operations. A dynamic mathematics software is used to give a mathematical instruction which is based on the multiple representations of vectors and vector operations. After this instruction a post-test similar to the pre-test is implemented and then the effects of this instruction to the students' understanding are analyzed and reported.

**Keywords:** Vectors, Vector Operations, Multiple Representation, Dynamic Mathematics Software, Vectors In Mathematical Context, Vectors In Physical Context



## TECHNOLOGY SELF-SUFFICIENCY OF SOCIAL STUDIES AND CLASS TEACHER CANDIDATES

*Özkan Akman*

This study was carried out to investigate the self-efficacy perceptions of social studies and classroom teachers regarding technology. The research is limited to third and fourth year students studying at Social Studies and Classroom Education Department of Gaziantep University Nizip Education Faculty. Survey method technique from research quantitative research techniques was used. In order to measure the teacher candidates' self-efficacy perceptions regarding technology, 'The Technology Proficiency Self-Assessment questionnaire' developed by Ropp (1999) and adapted to Turkish by Gençtürk, Gökçek and Günes (2010) was used. The data of the study were analyzed using the SPSS 22.00 package program. ANOVA, independent t test and descriptive statistical techniques were used in the study. According to the results of the research, it is seen that the technology self-efficacy of the teacher candidates is moderate. However, significant results were obtained in favor of women as a gender variable in technology. Among classroom and social studies teachers, social sciences teacher candidates' attitudes towards technology are higher. In addition, it has been seen that the prospective teachers use technology for the purpose of entertainment, play and communication rather than educational purpose.

**Keywords:** Social Studies Education, Classroom Education, Technology Self-efficacy

## THE ANALYSIS OF MENTORING PRACTICES' IMPACT ON THE INTRODUCTORY ACTIVITIES BY TEACHERS

*Ayşegül Sağlam Arslan, Nedim Alev, Tuncay Özsevgeç, Alpaslan Şahinoğlu*

Mentoring practices' positive impact on academic success, career development, and personal development has been observed in numerous studies. The present study, in turn, focuses on their potential contributions to teachers' classroom practices and acclimation with curriculum. For this purpose, the impact of eight weeks of mentoring was analyzed from a holistic perspective with reference to a number of distinct parameters within the framework of the present study providing a qualitative review of their impact on "Introductory Activities" of teachers. Three physics teachers were enrolled in the study on a volunteering basis. For a total of 16 weeks, each teacher's courses were observed before, during and after the mentoring practices. In this context, the observations prior to the mentoring process revealed the existing state and the current teacher profiles of the teachers, while the observations during the mentoring process enabled the analysis of the process' reflections on the activities in the classroom. The observations to follow the mentoring process, in turn, served to assess how lasting would the impact thereof would be on teachers' practices. The items investigated within the framework of the introductory activities (greeting and entrance to the classroom, remembering previous knowledge - roll call, drawing attention, motivation, stating the target) are analyzed to establish the frequency of performance by the teachers, leading to the assessment of the Teacher's Application Score (TAS) for each item. The teachers' activities were categorized in 4 groups on the basis of these scores: Activities Needing Definite Improvement, Activities Recommended to be Improved, Already Developed Activities, and Overused Activities. The analyses led to mentoring processes taking into consideration the state of affairs prior to mentoring. Thereafter, the impact of the process was presented with reference to TAS. The data suggests that mentoring activities have a positive impact on the introductory activities on part of the participants, and that such impact was lasting in nature, even after the mentoring was discontinued.

**Note:** This study was carried out under the project code TUBITAK 214K043.

**Keywords:** Mentoring Activities, Teacher Practices, Introductory Activities



## THE ANALYSIS OF THE COGNITIVE STRUCTURE OF STUDENTS TOWARDS LUNGS CONCEPT BY WORD ASSOCIATION TEST

*Banu Çiçek Seyhan, Mehmet Diyaddin Yaşar, Aysel Temelli*

The purpose of this study is to determine cognitive structures of biology students by defining their conceptual frameworks. In the study, qualitative research methods were used. It was carried out with the participation of 60 students from Biology Teaching Department, Education Faculty and Science Faculty, Biology Department. Independent word association test and drawing-writing test were used for data collection. The data obtained were examined in accordance with content analysis. The research data were grouped under nine categories; these were separated as lungs and respiratory diseases, the structure of lungs, properties of lungs, functions of lungs, factors of lung diseases, living creatures with lung respiratory, the organs that help lungs, main respiratory organs and location of lungs in the body. The students were also determined to have some alternative concepts about lungs.

**Keywords:** Biology Education, Lungs, Word Association Test, Cognitive Structure.

## THE COMPARISONS OF QUANTITATIVE AND QUALITATIVE PROBLEMS ON STUDENTS' PHYSICS ACHIEVEMENT

*Tolga Gok*

Problem solving is quite important for physics and physics education. Besides, it is essential for students to develop the scientific and analytical thinking processes. These processes can be taught to students with the help of the scientific and analytical thinking. Generally instructors solve some fundamental quantitative problems regarding the subjects after they teach the subjects in the traditional instruction model. Students also prefer to memorize some solution ways of the problems by using basic equations or formulas concerning the problems instead of learning of the solution ways of the problems. These kinds of approaches do not lead to sufficient learning for the students. Solely, knowing the fundamental equations/formulas are not enough for problem solving. The instructors need to tend more on teaching of the qualitative problem solving. Therefore, this study was investigated the effects on students' quantitative and qualitative problem solving achievement. The study was conducted to 80 university students. The students were asked four problems in final examination which are consisted of two qualitative and two quantitative problems. The problems were about "Newton's Laws" and "Work and Energy Chapters". Students' solutions were analyzed and reported. Some suggestions in the light of investigation were presented in the end of the research.

**Keywords:** Higher Education, Problem Solving, Scientific Thinking



## THE COMPARISONS OF THE FRACTIONAL GAIN IN CONCEPTUAL LEARNING BY USING PEER INSTRUCTION

*Tolga Gok*

Traditional instruction is not sufficient in science, technology, engineering and mathematics education at the present time. Therefore new teaching strategies and methods have consistently been developed by the scientists. One of the new developed teaching methods is peer instruction. Peer instruction is interactive teaching method. Peer instruction is quite easy and practical to implement therefore peer instruction might be adapted to different disciplines of science, social, and engineering. The effectiveness of peer instruction and traditional instruction on students' conceptual learning were compared by calculating fractional gains with the help of some standardized tests (Force Concept Inventory-FCI, Force and Motion Conceptual Evaluation-FMCE, Conceptual Survey of Electricity and Magnetism, CSEM) in this study. The normalized gains of studies performed and accessed between 1990 and 2016 were evaluated and discussed. When the examined studies were generally interpreted, students' conceptual understanding performances instructed with peer instruction were higher than students' conceptual learning performances taught with traditional instruction.

**Keywords:** Conceptual Learning, Peer Instruction, Standardized Tests

## THE EFFECT OF BRAIN-BASED LEARNING ON STUDENTS' METACOGNITIVE AWARENESS

*Behiye Akçay, Sibel Adigüzel, Hilal Çağap, Rüyeyda Yavuz*

The purpose of this study is to examine effects of Brain-Based Learning method on seventh grade students' metacognitive awareness. Thirty-five seventh grade students (23 girls, 12 boys) participated in this study voluntarily. The unit of "Structure and Properties of Matter" has been taught using Brain-Based Learning method for six weeks. Students' notebooks, Strategy Evaluation Matrix (Schraw, 1998), Regulatory Checklist (King, 1991), and Course Evaluation Essays were used for qualitative data. Metacognition Scale (Yıldız et al, 2009) was applied as pre-posttest for quantitative data. According to the results, the findings from Students Notebooks and Course Evaluation Essays showed that students exhibit positive metacognitive awareness for science lesson. This study indicated that Brain-Based Learning methods improve the metacognitive awareness of students in a positive way.

**Keywords:** Brain Based Learning, Cognitive Awareness, Metacognition, Structure Of Matter,



## THE EFFECT OF COOPERATIVE EXPERIMENT METHOD AND USING ANIMATION ON STUDENTS' MOTIVATION AND ANXIETY TOWARDS SCIENCE COURSE

*Özlem Ağgöl, Şeyma Çaliklar, Emre Yıldız, Ümit Şimşek, Yasemin Koç*

The aim of this study is to determine the effect of Cooperative Experiment Method (CEM) and animation technique on 6th grade students' motivation and anxiety towards science course in "Conduction of Electricity" unit. The sample of this study consist of 28 students from CEMG and 25 students from AG, totally 53 students from two different 6th grade classes of a secondary school in Ağrı. Pre- and posttest comparison group of quasi-experimental design was used in this study. As data collection instruments, the Science Motivation Scale (SMS) and Science Learning Anxiety Scale (SLAS) was implemented as pre- and posttest. Independent samples t- test was used for the data analyzes. Before implementation, it was seen that there was not a statistically significant difference between CEMG and AG, SMS and SLAS pre-test average scores ( $p>0.05$ ). After implementation, there was not a statistically significant difference between SLAS posttest average scores ( $p>0.05$ ), there was a significant difference between SMS posttest average scores in favor of CEMG ( $p<0.05$ ).

**Keywords:** Experiment, Animation, Motivation, Anxiety



## THE EFFECT OF DESIGN-BASED FETEMM ACTIVITIES ON PRE-SERVICE SCIENCE TEACHERS' INTEGRATED FETEMM TEACHING TENDENCIES AND FETEMM ATTITUDES

*Mehmet Şahin, Halit Kiriktaş, Sinan Eşlek*

The purpose of this study is to investigate the influence of the engineering design activities in which STEM areas are integrated on the orientation of science teacher candidates towards Integrated STEM instructional orientations and STEM domains. In the study, pre-test semi-experimental design with post-test control group was used. A total of 92 prospective science teachers participated in the study, 56 of whom were in the study at the state university and 36 of whom were in the control group. In the study,

which was designed as a 12-week application process, during the first two weeks of the process, prospective teachers were informed about engineering design and integration process of STEM areas and sample events were done with the participants. In the course of the process, 4 problem cases were given to the teacher candidates in this field and it was asked to develop design activities for these situations. Mixed research design will be used in the process. In this context, the quantitative data will be collected with STEM teaching orientation scale and STEM attitude scale. Qualitative data will be obtained through interview questions and content analyzes of design reports. T-test, ANOVA, % and frequency analysis will be done on the data. At the end of the study, it is expected that awareness about STEM areas and engineering design process in teacher candidates and their attitudes change positively..

**Keywords:** Stem, Engineering Design, Teacher Candidate



### THE EFFECT OF DRAMA SUPPORTED TEACHING ON UNIVERSITY STUDENTS' SUCCESS IN ELECTROSTATIC SUBJECT AND ATTITUDES TOWARDS THE DRAMA METHOD

*Ayşe Gül (çirkinoğlu) Şekercioğlu*

Making use of only one teaching method in delivering specific physics subjects are not effective. Thus, making use of more than one teaching method in such physics subjects ensures efficiency and entertainment of the course through increasing students' attention and motivation. In this study, in addition to traditional method, the subject of electrostatic was presented to university students who took Physics 2 course through drama method. This study aims to determine the effects of this practice on students' achievements in the course. In this sense, drama scripts were written by the researcher concerning the electrostatic unit, and these scripts were applied to a class of 42 university students studying at Balıkesir University, Necatibey Education Faculty, Primary Grade Mathematic Education Department in the 2015-2016 education year, spring term. These scripts were used in the Physics 2 course, electrostatic subject, which were presented by using drama method in addition to traditional methods such as direct teaching and solving questions. The data collection instruments of the study were the Electrostatic Concept Test which was used as both pre and post-test, and the Drama Method Attitude Scale which was applied to determine students' attitudes towards the drama method. The reliability coefficients of the Electrostatic Concept Test data were 0.73 while it was 0.95 for the Drama Method Attitude Scale. The study results found out statistically meaningful differences between the pre and post test scores of the participant students, and determined a positive attitude among students towards the use of the drama method.

**Keywords:** Key Words: Drama, Electrostatic, University Students.



### THE EFFECT OF GENDER AND GRADE LEVEL ON RURAL SARAWAK INDIGENOUS SECONDARY SCHOOL STUDENTS' ATTITUDES TOWARD CHEMISTRY LESSONS TO ENHANCE LEARNING

*Murugan Mini Ratamun, Kamisah Osman*

The aim of this study is to investigate the interaction effects between gender and grade level among rural indigenous secondary school students' attitude towards chemistry in Sarawak, Malaysia. The students' attitudes were measured using Attitude towards Chemistry Lesson scale (ATCLS) form with multidimensional questionnaire to provide the interaction effects between gender and grade levels. The subscales which involve in ATCLS are liking for chemistry theory lessons, liking for chemistry laboratory



work, evaluative beliefs about school chemistry and behavioral tendencies to learn chemistry. ATCLS was administered to 470 rural indigenous secondary school students between age 16-18 years old which involve 177 male and 293 female students. Only two grade level was chosen in this study that is form 4(245) students and form 5 (225) students. The two-way MANOVA statistical analysis were used to identify the effects of gender and grade level on rural indigenous secondary school students' attitude towards chemistry. The finding show that gender (Wilks' lambda = 0.955,  $F(4, 463) = 5.47$ ,  $p < 0.001$ ) and grade level (Wilks' lambda = 0.969,  $F(4, 463) = 3.68$ ,  $p < 0.05$ ) have a significant effect on attitude towards chemistry. The finding also show that no significant interaction effect between gender and grade level (Wilks' lambda = 0.983,  $F(4, 463) = 2.03$ ,  $p > 0.05$ ) on rural indigenous secondary school students' attitude towards chemistry.

**Keywords:** Attitude, Gender, Grade Level, Indigenous Students, Learning Chemistry



## THE EFFECT OF INQUIRY-BASED SCIENCE ACTIVITIES ON PROSPECTIVE SCIENCE TEACHERS' SCIENTIFIC PROCESS SKILLS

*Murat Çetinkaya*

Science education, which aims to develop the individual's mental process skills, requires active participation in the process. The most important factor in science education is inquiry. Inquiry-based science education helps individuals to gain learning skills and to develop positive attitudes towards learning. The most frequent problem in science, technology, engineering and mathematics education is students' fears about these subjects. One of the reasons for having such a fear can be the methods of teaching. A teacher with scientific inquiry skills will reflect these to teaching programs and teaching strategies. In an exact opposite situation, students' fears can increase more. Thus, teachers should have the highest level of inquiry-based science skills. A teacher who has developed inquiry skills will also develop scientific process skills. This in turn will be a very important opportunity for students. The purpose of the study is to research to what extent inquiry-based nature of science lesson will affect prospective teachers' scientific process skills. Inquiry-based activities were developed with the study group in nature of science lesson. The sample of the study consists of Ordu University science teaching department students ( $n=32$ ). The study uses a mixed research design consisting of quantitative and qualitative research methods. Semi-structured interviews and self-assessments of students were used to collect qualitative data. Qualitative data were analyzed with "content analysis" approach. Quantitative data were collected with the scale of scientific process skills which had 36 items and Cronbach's alpha internal consistency of .70. The scale was given as pre-test and post-test at the beginning and end of the study. Quantitative data were analyzed by using "single group pre-test post-test experimental design". Pre-test and post-test data were analyzed by using "dependent samples t test". It is expected from the data analysis of the research that inquiry-based science education is effective for prospective teachers' developing their scientific process skills.

**Keywords:** Science Education, Inquiry-based Science, Scientific Process Skills, Scientific Inquiry



## THE EFFECT OF META-COGNITION ON POSITIONING AND EMOTIONS IN AUTHENTIC MATHEMATICAL ACTIVITIES

*Wajeeh Daher, Ahlam Anabousy*

Researchers of mathematics education have been paying attention to the affective aspect of learning mathematics for more than one decade. Different theoretical frameworks have been suggested to analyze

this aspect, where we utilize the discursive framework in the present research. This framework enables to link students' positions to their emotions. Here, we add to this relationship the meta-cognition variable, where we study how the new variable affects students' positioning in mathematical activities. A group of three Grade 7 high-achieving students participated in the research. They used GeoGebra to learn the topic of perpendicular lines through an authentic activity. The research results indicate that most of the means of claiming leadership were metacognitive in nature and were performed to enable the advancement of the group learning of the topic of perpendicular straight lines. These processes were requesting actions, initiating actions, performing actions, declaring actions, taking decisions, evaluation, monitoring and regulation. In one case – the case of Kamar, the claiming of leadership was accompanied with positive affect, namely enthusiasm, determination, and enjoyment. In the other case – the case of Salim, the claiming of leadership was accompanied with positive affect that differed from that of Kamar. In this case, the positive affect was self-confidence and being proud of oneself.

**Keywords:** Meta-cognition, Positioning, Emotions, Authentic Activity, Mathematical Activity

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## THE EFFECT OF READING-WRITING-GAME METHOD ON STUDENTS ACADEMIC ACHIEVEMENTS AND READING COMPREHENSION SKILLS

*Emre Yildiz, Özlem Ağgöl, Şeyma Çaliklar, Ümit Şimşek, Yasemin Koç*

The purpose of this research is to find out the effect of teaching "Conduction of electricity" unit, which is covered in the 6th grade science course, through the reading-writing-game method and program based learning on students' academic achievements, and reading comprehension skills. Pretest-posttest control group quasi-experimental design was used from the experimental designs in the study in which the quantitative research model was adopted. The sample of this study consisted of a total of 49 students from two 6th grade sections of a middle school in Ağrı's central districts in the 2015-2016 academic period. 25 students were selected for the experimental group in which the reading-writing-game method was applied and 24 students for the control group in which program based learning was applied. The application lasted for a total of 7 weeks (28 lesson hours) including pre-test and post-tests. The data were collected via the Academic Achievement Test and Reading Comprehension Test. Since the data obtained from the measurement tools were suitable for performing parametric tests, independent samples t-test was performed. The reading-writing-playing method applied in the experiment group was formed by integrating the educational game method instead of the last step application of the reading-writing-application method used in the cooperative learning model. At the beginning of the method, each student in the cooperative learning groups made individual reading about the subject. With the completion of the reading phase, the resources were removed and the group members made a report together with the readings made on their minds. The reports were reviewed by the researchers, and when the groups were found to be inadequate, they sent back to the reading stage, and when the reports were sufficient, groups passed to the final stages of the method. The games organized in relation to the subject were played under the guidance of researchers. Program-based instruction in the control group includes the same application of the curriculum proposed by the Ministry of Education on the basis of student textbooks. In this method, the important parts of the subject were explained by the researchers in an attempt to keep communication with the students at the maximum level, and all the activities required to make the students active were done. It was determined that there was no statistically significant difference between the readiness levels of the students at the beginning of the application. In other words, the level of the students' prior knowledge is similar. At the end of the application, it was found that the academic achievements of the students who applied reading-writing-game method is significantly higher than the students who applied program based learning. It was found that there is no significant difference between reading comprehension skills of students at the beginning of the application. However, at the end of the

study, it was determined that the students' reading comprehension skills who applied reading-writing-game method were significantly higher than who applied program based learning.

**Keywords:** Academic Achievement, Cooperative Learning, Educational Game, Reading Comprehension Skill, Reading-writing-application



## THE EFFECT OF TEACHING THE ATOMIC STRUCTURE OF MATTERS BY CREATIVE DRAMAS TO THE ACHIEVEMENT OF STUDENT AT THE 6 TH CLASS SCIENCE AND TECNOLOGY LESSON IN PRIMARY SCHOOL

*Selman Tuncel, Mustafa Pehlivan, Seyit Ahmet Kiray*

The purpose of this research is to examine the effect of teaching creative drama method on student achievement in primary science course. For this purpose, teaching with creative drama method was compared with traditional method. The Research was conducted with 6th grade student in the fall semester of the academic year 2008-2009. In the study, pre-test and post-test control semi-experimental design was used. As a result of the research, a statistically significant difference was found in favor of "Particle Structure of Matter" unit by Experimental group learning through creative drama method. The results of the research show that the use of creative drama method in the teaching of granular structure unit of madden increases student achievement.

**Keywords:** Creative Drama, Science Education, Atomic Structure Of Matter



## THE EFFECT OF TEACHING THROUGH USING DIFFERENT METHODS ON DEVELOPMENT OF MATHEMATICAL REASONING AND ATTITUDE

*Emrullah Erdem, Yasin Soylu*

As traditional teaching approach ignores individual differences and underestimates mental structure of individuals, it has been replaced by new approaches. Designing learning environments by using these new approaches is of high importance since it aims to develop mathematical reasoning skill which is an indispensable factor that ensures critical, reasonable and deep thinking and is also important for doing maths. The present study aims to reveal the effect of learning environment enriched using different teaching methods on mathematical reasoning and attitude. The study was carried out with 27 seventh grade students who were studying in a randomly selected state school located in a city centre in Turkey. Education on fractions and integers given in the designed environment lasted for eight weeks (32 hours in total) with the use of educational games, concrete materials, cartoons and computer-assisted applications helping students to relate them to their daily life and working in cooperative heterogenous groups. Data were collected through answers given by students to Mathematical Reasoning Test (MRT) and Mathematical Attitude Test (MAT) during pre-test and post-test. Answers given to MRT and MAT tests were analyzed by Wilcoxon Signed Rank Test. Analysis show that the teaching significantly develops students' mathematical reasoning and improves students' attitude towards maths.

**Keywords:** Mathematical Reasoning, Different Teaching Methods, Attitude, 7th Grade Students

## THE EFFECT OF THE WEB-BASED PROBLEM SOLVING METHOD IN THE COMPUTER PROGRAMMING COURSE ON ACADEMIC ACHIEVEMENT, ATTITUDE TOWARDS COMPUTER PROGRAMMING LEARNING AND COURSE INTEREST

*Bariş Emlek, Ahmet Oğuz Aktürk*

The purpose of this study is to investigate the effect of the web-based problem solving method in the Computer Programming course on academic achievement, attitude towards computer programming learning and course interest. Semi-experimental pretest-posttest control group design was used in the study. The working group of the study consists of 59 second year students studying at the Mathematics Department of a large university in Konya. The study was conducted in the course of Computer Programming, which was taught in the spring semester of the 2014-2015 academic year and the 59 students were randomly assigned to the experimental and control groups. As a result of the random assignment, 29 students were in the experimental group while 30 students were in the control group. The instructions for both groups were directed by the course instructor for 14 weeks. Whereas the Computer Programming course was conducted using the web-based problem solving method in the experimental group, for the control group face-to-face using the traditional method was used. According to the results of the study, the consequence of the experimental treatment showed that the academic achievements of the students in the experimental group increased more compared with the students in the control group while their course interest (attention, relevance, confidence and satisfaction) increased more only in the confidence sub-dimension and their attitude towards learning computer programming increased more in all of its sub-dimensions (willingness, negativity and necessity). The results also showed that the web-based problem solving activities conducted in the experimental group generally increased academic achievement, course interest and attitude towards learning computer programming.

**Keywords:** Web-based Problem Solving, Computer Programming, Academic Achievement, Interest In The Course.



## THE EFFECT OF USING VIRTUAL LABORATORY ON GRADE 10 STUDENTS' CONCEPTUAL UNDERSTANDING OF DIRECT CURRENT ELECTRIC CIRCUIT AND THEIR ATTITUDES TOWARDS PHYSICS

*Malak Abou Faour, Zalfa Ayoubi*

This study aimed to deal with the virtual laboratory (VL) as being one of the suggested solutions of the insufficient lab equipment and conditions problem. It investigated the effect of using (VL) on grade 10 students' conceptual understanding of the direct current electric circuit and their attitudes towards physics. The research used a quantitative experimental approach. The convenient sample of the study was formed of 50 students of the tenth grade of an official secondary school in Mount Lebanon. Participants were randomly assigned into two groups of 25 students each. The experimental group was taught using VL, where experimental activities were conducted through Circuit Construction Kit developed by the PhET simulations. However, the control group was taught through interactive demonstrations using real laboratory equipment. Both groups were pre and posttested by means of two instruments: "Determining and Interpreting Resistive Electric current Concepts test" (DIRECT) to assess the students' conceptual understanding of the direct current electric circuit, and "Physics Attitude Scale" (PAS) to evaluate the changes in their attitudes towards physics. The data analysis of the DIRECT test scores showed that, after 10 weeks, the conceptual understanding of the direct current electric circuit had markedly improved in both groups. However, the mean score of the experimental group was significantly higher than that of the control group. On the other hand, there was no significant difference in students' attitudes towards physics between the two groups. In addition, a statistically positive significant correlation was detected between the students' conceptual understanding of the direct current electric circuit and their attitudes towards physics.

**Keywords:** Physics Teaching, Conceptual Understanding, Virtual Laboratory, Interactive Demonstrations, Students' Attitudes

## THE EFFECTS OF ACTIVITIES WITH 5E MODEL PREPARED AS PART OF CONTEXT BASED SCIENCE EDUCATION ON STUDENT SUCCESS

*Cemil Aydođdu, Özge Sari Ay*

Mankind needs to learn science to recognize itself, its environment and the natural world, to transfer natural resources to the next generations in a usable way, to organize the relations between them and to control the events taking place around them. For this reason, today, science and technology are developing rapidly. As a product of this, a lot of information is formed. It is difficult to teach this information effectively and permanently in schools. Therefore, it is impossible to acquire the knowledge that is growing and renewing at a fast pace, and it is impossible to fit this process into specific learning periods. This problem should be tried to be solved by "learning to learn" instead of trying to learn everything (Taşkesenligil, Şenocak and Sözbilir, 2008). The inadequacy of traditional methods, the impossibility of embodying the information students learn and the inability to use them in real life situations has become the main problem of schools. There is a constructivist approach in the subset of life-based learning. In a life-based learning approach, a day-to-day life event or a question is taken as a starting point. The information learned in this way becomes a necessity. Thus, it is aimed to use concepts and associations as a tool to solve these events and problems (Acar and Yaman, 2011). In this way, students can connect the concepts they learn with everyday life. Every individual in the modern world needs to understand what science is, how knowledge is obtained in the field of science, and how it plays a role in our daily lives. Science covers a wide spectrum of people's lives from the air they breathe, the water they drink, the world they live to, the smallest technological tools they use (Demirci, 1993). The world is full of students who cannot apply what they learn at school, who cannot apply their knowledge, and who are suffering from unrelated education (Dunn, 1994). There is no educational value of an education isolated from everyday life (Binbaşıođlu, 2004). There are few studies that examine the contributions of the activities based on life-based science education to the learning of science courses. This study aims to investigate the influence of 5E Model Activities prepared within Context Based Science Education on the achievement of fifth graders and also to take their opinions about the activities at the end of the teaching process. For this purpose, on the subjects "Heat and Temperature, Human and Environment Relationship, Variables Influencing the Brightness of Lamp in a Simple Electrical Circuit", from the fields of physics, chemistry and biology, 5E model activities within Context Based Science Education were developed, administered and at the end students were asked to state their opinions regarding the process. Population of the study consisted of 60 students studying at two different fifth grade classes at a secondary school in Ankara which was determined using convenience sampling method. In this study in which interwoven pattern mixed method of research design was made use of, data was collected through achievement tests developed by the researcher, which were "Heat and Temperature Achievement Test, Human and Environment Relationship Achievement Test, Variables Influencing the Brightness of Lamp in a Simple Electrical Circuit Achievement Test" and semi-structured interview forms prepared by the researcher. Data was analysed using descriptive data processing methods and the results were presented as average, standard deviation, table and graphic presentation. In order to provide equilibration between groups, independent samples t-test was used to analyse pre-test scores; dependent samples t-test and ANCOVA were used in order to find out if there was a meaningful difference between the average pretest-posttest scores of achievement test and environmental consciousness scale. Semi-structured interviews were analysed making use of content analysis method. Results revealed that the method used increased achievement. Also, it was concluded that students perceived their learning environment as constructivist. At the end of the study recommendations regarding alternative activities and applications for improving context based science education activities were presented.

**Keywords:** Context Based Science Education, 5e Model, Science Teaching, Student Achievement, Student Opinions.

## THE EFFECTS OF ACTIVITIES WITH 5E MODEL PREPARED AS PART OF CONTEXT BASED SCIENCE EDUCATION ON STUDENTS' ENVIRONMENTAL CONSCIOUSNESS

*Cemil Aydođdu, Özge Sari Ay*

This study aims to investigate the influence of 5E Model Activities prepared within Context Based Science Education on their improvement in terms of environmental consciousness of fifth graders. For this purpose, on the subjects "Heat and Temperature, Human and Environment Relationship, Variables Influencing the Brightness of Lamp in a Simple Electrical Circuit", from the fields of physics, chemistry and biology, 5E model activities within Context Based Science Education were developed and administered. Population of the study consisted of 60 students studying at two different fifth grade classes at a secondary school in Ankara which was determined using convenience sampling method. In this study in which interwoven pattern mixed method of research design was made use of, data was collected through environmental consciousness scale which developed by another researcher. Data was analysed using descriptive data

**Keywords:** Context Based Science Education, 5e Model, Science Teaching, Environmental Consciousness.



## THE EVALUATION OF THE MATERIALS DEVELOPED BY TEACHER CANDIDATES: WITH THE PERSPECTIVE OF RESEARCHER, PEER AND SELF-EVALUATION

*Sibel Demir Kaçan, M.handan Güneş*

Developing and changing dynamics of the world affect our lives in all fields. It is not possible not to be affected by this dynamism ranging from health sector to education sector. Teacher candidates play a vital role in raising the generation that will be a part of world dynamics. Teacher candidates need to achieve different perspectives by improving themselves both technologically and materially. Therefore, it is thought that the teacher candidates in faculties of universities have an adequate level of competency in terms of instructional technologies and material design. Based on this expectation, the aim of this study to enable the teacher candidates studying in 5th grade of biology teaching department to evaluate the biology related materials that were improved for the courses of instructional technologies and material design by having the perspective of researcher, peer and self-evaluation. This study has been conducted with 23 5th grade students studying in the department of biology in a university in Black Sea region of Turkey. Three forms have been distributed to the biology teacher candidates as data collection tools of the study. The data that have been collected from such forms were evaluated by comparing content analysis with the percentages. Content analysis is implemented as a technique in which an information can be deeply examined through some codings and categories. By means of the results obtained from the study, interpretations have been made and suggestions were offered.

**Keywords:** Science Education, Teacher Candidate, Instructional Technologies, Biology Education, Material Development

## THE IMPACT OF MENTORING ACTIVITIES ON SELF-EFFICACY LEVELS OF TEACHERS: THE CASE OF PHYSICS TEACHERS

*Ayşegül Sağlam Arslan, Nedim Alev, Tuncay Özsevgeç, Alpaslan Şahinoğlu*

Mentoring practices have found extensive use in developed world, particularly in helping professional development of teachers, and are used in this study, to support the in-class practices envisaged by the current curriculum. Mentoring practices' impact on academic success, career development, personal development, and positive change in behaviors and attitudes, as well as in providing motivation has been observed in numerous studies. Self-efficacy scales are employed to enable teachers assess their personal and academic careers. The literature often defines the concept of self-efficacy along the general lines of a self-assessment on part of the individual, to guesstimate how successful she would be in overcoming problems she may face in the future. In this context, the present study intends to review the change in the self-efficacy levels of three physics teachers who have volunteered to take part in mentoring practices. To assess the change, the self-efficacy scale developed by Kahyaoglu and Yangin (2007) was applied with the teachers, before and after the 8 weeks of mentoring. The specific sub-groups of the 5-grade likert scale on self-efficacy, composed of 44 items, were established by the mentors providing the mentoring. The scales were analyzed with a holistic and analytical perspective, leading to the conclusion that the mentoring process had certain positive influences on the self-efficacy of teachers. In this context, the participants' focus on "I am moderately effective" responses for items on teacher efficacy, prior to the mentoring process was found to be replaced by "I am quite effective" and "I am completely effective" responses after the mentoring, coupled with the observation of positive change in the scores teachers received in the overall self-efficacy scale.

**Note:** This study was carried out under the project code TUBITAK 214K043.

**Keywords:** Mentoring Practices, Teacher Training, Self-efficacy

## THE INFLUENCE OF THE EDUCATION PROVIDED BASED ON RESEARCH INQUIRY BASED LEARNING APPROACH ON THE PRESERVICE TEACHERS' PLANNING PROCESSES

*Nesli Kala Aydin, Selcan Sungur Alhan, Nur Akcanca, Tolga Saka*

The purpose of the research is to examine the change in the lesson planning processes of preservice science teachers after the training based on the research inquiry-based learning approach (RIBLA). The research was conducted with 12 preservice science teachers, who have been taking the classes of Science Training Laboratory Applications-II at a state university in Anatolia in spring semester 2015-2016. Preservice teachers have been given a three-stage training on RIBLA during one semester period. After each step of the given training, the preservice teachers were asked to prepare course plans based on the related teaching approach. At the first stage of the training, a seminar about what RIBLA is, its place in science education, and its importance was given. After this seminar, the appropriate achievements that the preservice teachers can research and inquire from the science training curriculum were determined; and these were given to preservice teachers randomly. In the second phase of the training, sample lesson plans prepared by experts based on RIBLA were examined with preservice teachers. At the last stage, the videos of the lessons that specialist teachers carried out based on RIBLA in the real classroom environment were watched; and the opportunity to examine these videos were given to the preservice teachers. Preservice teachers were asked to reconstruct the lesson plans they had prepared for the last time according to the experiences they have gained here. As the result of the research; it has been determined that the vast majority of preservice teachers have trouble with RIBLA at the "starting the inquiry" stage and that this problem is particularly in ensuring the students to ask questions. At this stage, it has been determined that some preservice teachers ask the research questions themselves and they have not been developed at the desired level in the process. It has been determined that some preservice teachers have problems in the summarization and evaluation part of the "sharing the comprehension" section, however, the vast majority of them solve this problem within the research process.

**Keywords:** Research Inquiry Based Learning Approach, Lesson Planning Process, Preservice Science Teacher

## THE INVESTIGATION OF MIDDLE SCHOOL STUDENTS', WHO PARTICIPATED TO SCIENCE FAIRS, MOTIVATION AND INTEREST LEVELS RELATION TO SCIENCE

*Olgun Han*

A high level of motivation and interest to science is important for increasing students academic success in science. In this study, the aims to determine the inference of TÜBİTAK 4006 science fairs on motivation and interest levels of secondary school students relation to science. The method of this study is quantitative method. The study includes 40 students from a religion vocational secondary school in Sultanbeyli İstanbul. 5th, 6th, 7th and 8th grades students take part in semi-structured investigation in this study. In the analysis of research data, descriptive analysis and content analysis techniques are used. According to research findings the students taking part in preparation process of science fairs are found to increase their motivation and interest levels relation to science. Various suggestions are included in research results, too.

**Keywords:** Science Fair, Content Analysis, Science Education



## THE INVESTIGATION OF THE EFFECTS OF ROBOTIC-ASSISTED PRACTICES IN TEACHING RENEWABLE ENERGY SOURCES TO SEVENTH-GRADE STUDENTS IN SECONDARY SCHOOL

*Sibel AçıŖli*

The purpose of the study is to teach the robotics-assisted lego training sets and renewable energy sources to 7th grade students in secondary school and examine the effects of practices on academic achievement and scientific process skills of students. The research was carried out with 20 students which study in the 7th grade of secondary school. A single group pre-test-post test model which is one of the pre-test designs, was used in the study. In the research, it was tried to be taught the renewable energy sources to students by using the Lego® Mindstorms EV3 Training Kit and the Lego® Renewable Energy Kit. The practice lasted total for 20 hours as 3 stages. At the first stage, Lego® Mindstorms EV3 Training Kit and Lego® Renewable Energy Kit were introduced to the students. At the second stage of the practice solar energy related materials and at the final stage wind energy materials of the practice were ensured to be designed by students, and it was made them do activities. In the research, as a mean of collecting data, "Alternative Energy Resources Achievement Test" developed by Hbek (2014) in order to measure the success of students on the topic of renewable and non-renewable energy sources, "Scientific Process Skill Test" developed by Okey, Wise and Burns (1985) and translated and adapted to Turkish by Geban, AŖkar and zkan (1992) in order to determine whether there is any change in the scientific process skills of the students and "Semi-structured interview form" in order to evaluate the perspectives of students on the use of legos as a course material, were used. The data obtained in the study were evaluated through the SPSS package program. In the light of this study, it was determined how students perceive education with legos as a method oriented the subject of renewable energy sources.

**Keywords:** Robotic, Renewable Energy Resources, Lego® Mindstorms Ev3 Education Kit, Lego® Renewable Energy Kit



## THE INVESTIGATION OF THE EFFECTS OF ROBOTIC-ASSISTED PRACTICES IN THE TEACHING OF RENEWABLE ENERGY SOURCES TO SCIENCE TEACHERS CANDIDATES

*Sibel Açıřli*

It is aimed to investigate the effect of robotic-assisted practices in the teaching of renewable energy sources to science teacher candidates in the study. Research was carried out with 20 volunteer teacher candidates who study at Artvin Çoruh University Faculty of Education Science Teacher Education in third grade. A single group pre-test-post test model was used in the study. The subject of renewable energy sources was tried to be taught to teacher candidates using the Lego® Mindstorms EV3 Training Kit and the Lego® Renewable Energy Kit. The practice lasted total for 20 hours in 3 stages. At the first stage, Lego® Mindstorms EV3 Training Kit and Lego® Renewable Energy Kit were introduced to teacher candidates. At the second stage of the practice, solar energy related materials and at the final stage of the practice, materials related to wind energy were ensured to be designed by them, and it was made them do activities. In the research, as a mean of collecting data, "Attitude Test for Renewable Energy Sources" developed by Güneş, Alat and Gözüm (2013) in order to determine the attitudes of teacher candidates about renewable energy sources, "Renewable Energy Awareness Scale" developed by Morgil, Seçen, Yücel, Özyalçın Oskay, Yavuz and Ural (2006) and was translated into Turkish by Tiftikçi (2014) in order to measure the attitudes of teacher candidates about renewable energy sources, the "Importance of Lego Use and Lego Familiarity Scale" developed by Sungur (2013) in order to evaluate the perspective of teacher candidates concerning lego use as a course material and semi-structured interview form in order to determine the opinions and suggestions of the teacher candidates about the robotically assisted practice were used. The data obtained in the study were evaluated through the SPSS package program. In the light of this study, it was determined that attitudes and awareness of teacher candidates concerning the renewable energy sources and how they perceive education with legos as a method.

**Keywords:** Robotic, Renewable Energy Resources, Lego® Mindstorms Ev3 Education Kit, Lego® Renewable Energy Kit, Teacher Candidates



## THE INVESTIGATION OF THE RELATIONSHIP BETWEEN SCIENCE TEACHER CANDIDATES' RISK PERCEPTIONS WITH DECISION MAKING STRATEGIES

*Umit Demiral, Hande Turkmenoglu*

The aim of this study is to examine the relationship between prospective science teachers' decision making skills on a socio-scientific issue with risk perceptions. For this purpose, holistic multiple-case design was used in qualitative research methods in the research. In this design, this is the situation that can be perceived as more than one in its entirety. Each situation is handled holistically in itself and then compared with each other. This study was carried out with a total of 210 teacher candidates who were educated in Ahi Evran University, Department of Science Teacher and 30 teacher candidates selected by purposeful sampling method. As a means of data collection tools in research, the Risk Perception Scale for GMOs and two scenarios prepared for GMO were used. The Risk Perception Scale for GMOs was applied to 210 teacher candidates. As a result of this application, prospective teachers were divided into two groups as low-high group with risk perception. Teacher candidates with low risk perception ( $n = 15$ ) and high risk perception ( $n = 15$ ) were selected by the purposeful sampling method. Then a face-to-face semi-structured interview was conducted with this teacher candidate. In addition, a follow-up interview was held to identify the underlying reasons for teacher candidates' decision-making skills on GMO. When the findings of the study are examined, prospective teachers with a high level of risk stated that human intervention in nature would have immediate negative effects on human health. Teacher candidates with high risk were determined to use intuitive and dependent decision making strategies by the reasoning with precautionary

arguments. Teacher candidates with low risk were determined to use rational and evasive decision-making strategies by making reasoning with the pros and cons arguments and the uncertainty arguments. Research findings have led to the conclusion that the risk factor is influential on decision making strategies based on reasoning. A number of suggestions have been made for teacher training programs related to the results.

**Keywords:** Science Education, Risk Perception, Decision Making



## THE MATHEMATICS OF LEARNING: LEARNING FORMULAS OF TEACHER CANDIDATES

*Ismail Şan*

The purpose of this study is to determine the parameters that are believed to influence learning and the learning formulas stem from that parameters. For this purpose, an open ended questionnaire on how and what they think about learning was applied to teacher candidates. Data was collected from 77 student mathematics teachers that was enrolled to teaching principles and methods course. Data is now analyzing in accordance with inductive content analysis. Study is at the data analysis step. After analysis, the views of student mathematics teachers about learning will be listed.

**Keywords:** Teacher Candidates, Mathematics, Learning Formulas



## THE POTENTIAL OF DIFFERENT MODES OF DELIVERY IN THE BLENDED LEARNING ENVIRONMENT IN HIGHER EDUCATION: A REVIEW PAPER

*Reem Baragash, Fauzi M Wan*

The blended learning environment has the potential to provide the best environment for enhancing student engagement and performance. While the varied nature of this environment offers different modes of learning delivery, these modes of delivery should be considered when discussing student engagement and performance. In this environment students have the potential to create new knowledge, interact with others through attending traditional face-to-face learning (F2F) mode and online through a LMS-based learning mode and beyond by using the Web-based learning (WBL) mode to make their educational experience more meaningful. The purpose of this review is to synthesize the available evidence in the literature on engagement in each mode in the blended learning environment and focus on its effects on performance. Thus, this paper attempts to review related studies in the period between 2004 and 2016 to provide a comprehensive overview of relevant research regarding the engagement in each of the three modes of delivery and their potential role to improve student performance in the blended environment. Also, discussed how online tools such as LMS and Web tools as well as contextual factors can potentially support student learning in this environment. Search terms used in the literature review included varied terms for blended learning, LMS-based learning, learning analytic, WBL, terms relevant to the performance and engagement in blended learning. The findings of this literature review and implications were discussed within the setting of blended learning and suggestions were given to future research.

**Keywords:** Delivery Modes, Blended Learning, Lms-based Learning, Web-based Learning.

## THE PREDICTIVE EFFECTS OF ENGAGEMENT IN SCIENCE LESSONS AND ATTITUDES TOWARD SCIENCE

*Yoon Fah Lay*

This study explored the predictive effects of students' engagement in science lessons and attitudes toward science on science achievement among Southeast Asian eighth graders in TIMSS 2015. In this study, students' views on engaging teaching in science lessons, students' interest in and liking of learning science, understanding about the importance of and the usefulness of the subjects (attainment value and utility value), and self-confidence or self-concept in their ability to learn science were measured. Data were obtained from 9,726 Malaysian students, 6,116 Singaporean students, and 6,482 Thai students who participated in TIMSS 2015. This study provides information on prerequisites of Southeast Asian students' science learning. Implications of the findings for educational policy and practice are discussed.

**Keywords:** Engagement In Science Lessons, Attitudes Toward Science; Science Achievement; Timss.



## THE PREDICTIVE EFFECTS OF SCHOOL CLIMATE ON SOUTHEAST ASIAN GRADE 8

*Yoon Fah Lay*

This study explored the predictive effects of school climate on science achievement among Southeast Asian eighth graders in TIMSS 2015. In this study, principals' and teachers' reports of school emphasis on academic success, teacher job satisfaction and challenges facing teachers, and students' sense of school belonging were measured. Data were obtained from 9,726 Malaysian students, 6,116 Singaporean students, and 6,482 Thai students who participated in TIMSS 2015. This study provides information on prerequisites of Southeast Asian students' science learning. Implications of the findings for educational policy and practice are discussed.

**Keywords:** School Climate; Emphasis On Academic Success, Job Satisfaction, Science Achievement; Timss.



## THE RELATIONSHIP BETWEEN CONSTRUCTIVIST LEARNING ENVIRONMENT AND STUDENTS' CRITICAL THINKING DISPOSITIONS IN SCIENCE

*Bircan Dökmecioğlu, Yasemin Taş, Sündüs Yerdelen*

The purpose of this study is to examine how middle school students' perceptions of the constructivist learning environment in science class predict students' critical thinking dispositions. Totally, 165 middle school students in Erzurum participated in the study. Quantitative research design and correlational research method were utilized. To collect data UF/EMI Critical Thinking Disposition Instrument and Constructivist Learning Environment Scale were used. According to the results of multiple linear regression analysis, personal relevance, critical voice, and shared control were found to be statistically significantly and positively related to participation, one of the subscales of critical thinking dispositions. Besides, personal relevance, critical voice, and student negotiation statistically significantly and positively predicted cognitive maturity subscale of critical think disposition. Finally, personal relevance, uncertainty, and critical voice statistically significantly and positively predicted innovativeness. Critical voice was found to be the best predictor among constructivist learning environment features. The explained variance in critical thinking dispositions ranged from 61% to 75%.

**Keywords:** Perceptions Of Constructivist Learning Environment, Critical Thinking Disposition, Science

## THE ROLE OF METACOGNITIVE GUIDANCE ON PRE-SERVICE TEACHERS' EMOTIONS DURING PRACTICUM

*Zubeyde Demet Kirbulut, Esen Uzuntiryaki-kondakci*

Emotions play a pivotal role for pre-service teachers' future teaching and professional identity. Teacher education programs are considered a key stage in the development of teacher identities. Therefore, there is need for studies to generate awareness on the importance of teacher emotions in teacher education programs. In addition, researchers argued that cognition and emotion are fully integrated, which implies that cognitive reflections can guide or determine emotions. Teaching is emotionally loaded profession. We need to know more about pre-service teachers' emotional experience and emotion regulation process. Accordingly, the purpose of the current study was to investigate the role of metacognitive guidance on pre-service teachers' emotions during practicum. The participants of the study were 13 elementary pre-service teachers (9 females and 4 males) who enrolled teaching practice course. Qualitative document analysis was utilized. Elementary pre-service teachers kept four diaries throughout teaching practice course in a 12-week period. The first diary was about their emotions before teaching practice. The second and third diary focused on how their emotions changed during practicum. The last diary was about reflection of the use of metacognitive guidance in teaching practice course on their emotions. Diaries written by elementary pre-service teachers were used as a data source. Data was analyzed using deductive content analysis. Results showed that pre-service teachers experienced various positive and negative emotions, which could be activating or deactivating, during teaching practice. Pre-service teachers elucidated more positive emotions than negative ones at the end of teaching practice. They emphasized that metacognitive guidance during practicum made them become aware of their emotions. Moreover, they added that they learned how to regulate their negative emotions. The findings of this study have the potential for designing effective teacher professional development programs.

**Keywords:** Pre-service Teachers, Emotion, Metacognition



## THE THINKING STYLES OF SECONDARY SCHOOL STUDENTS AND THEIR INTERNET USAGE

*Canan Koçak Altundağ, Fatma Alkan, Murat Altundağ*

Internet use increases rapidly all over the world. Controlling this increase is important especially for children. Using internet so often emerges as a problem in children who grow up in the digital age. The aim of this study is to analyze the relationship between thinking styles and using safe internet of secondary school students. Within the scope of the research, data was collected from 50 secondary school students studying in the city center of Ankara. Based on a relational scanning model, the study used "Thinking styles Inventory" developed by Sternberg-Wagner (1988) and adapted to Turkish by Kaya (2009) and Fer (2005), and "Safe Internet Usage Scale" developed by Beder (2015) for the purpose of data collection. During the data collection phase from secondary school students, video-assisted survey study is applied. Frequency and percentage values concerning thinking styles were calculated, and chi-square test was used to determine the differentiation of safe internet using according to thinking styles. According to the results of research; the usage of safe internet, the awareness and beliefs of students are generally higher. The study indicated that students had legislative, executive, judicial, global and local dimensions of thinking styles. The results were important by showing that thinking styles and safe internet usage were closely related to each other and there were number of factors, related to a person's locus of control and thinking styles. The results of the research created a reference point related the development of applications on safe internet usage.

**Keywords:** Secondary School Students, Safe Use Of The Internet, Internet Skills, Thinking Styles

## THE VAN HIELE LEVELS OF GEOMETRIC THINKING AMONG EAST JERUSALEM MATHEMATICS TEACHERS

*Shaker Rasslan, Daoud Afifi*

Geometry is one of the major academic subjects in math curriculum in primary, middle, and secondary schools. This field is perceived as one of the most complicated mathematical fields. Studies conducted, reported on difficulties encountered by students, math pre-service and math teachers in learning and teaching geometry. Van Hiele theory (van Hiele, 1986) involving levels of thinking in geometry that students pass through as they progress from merely recognizing a figure to being able to write a formal geometric proof. The theory explains why many students encounter difficulties in their geometry course, especially with formal proofs. According to van Hiele theory there are five levels of geometric thinking, which are sequential and hierarchical: recognition (visualization), analysis, abstraction, deduction, and rigor. Internalization such levels by math teachers has a direct impact on understanding geometry by students. Research from around the world did several large studies on the van Hiele theory since 1970s (Usiskin, 1982; Senk, 1985). These studies influenced American NCTM Standards and Common Core State Standards. The number of Arab residents in East Jerusalem (2013) is about 305,500 (ir amim, 2016). Arab math education system in East Jerusalem adopted the math curricula of "The Palestinian Ministry of Education". This paper focused on van Hiele theory of geometric thinking among Arab math teachers (N=100 math teachers, from 24 schools, with between 10-20 years' experience) from east Jerusalem. We adapted the Arabic version of Usiskin's test (Rasslan, Rasslan-Sharif & Yosif, 2013). The results are extremely not encouraging when it comes to math teachers: 86% of our sample achieved the 3rd level. But only 38% achieved Level 4 and only 9% achieved level 5.

**Keywords:** Van Hiele Levels Of Thinking, Geometry, Mathematical Thinking



## THE VAN HIELE LEVELS OF GEOMETRIC UNDERSTANDING AMONG EAST JERUSALEM PRE-SERVICE MATHEMATICS TEACHERS

*Shaker Rasslan, Fadi Othman*

Geometry is one of the major academic subjects in math curriculum in primary, middle, and secondary schools. This field is perceived as one of the most complicated mathematical fields. Studies conducted, reported on difficulties encountered by students, pre-service and in-service teachers in learning and teaching geometry. The main reason for these difficulties is the gap between the level of teaching and learning abilities and understanding of learners. The Van Hiele theory (van Hiele, 1986) involving levels of thinking in geometry that students pass through as they progress from merely recognizing a figure to being able to write a formal geometric proof. The theory explains why many students encounter difficulties in their geometry course, especially with formal proofs. According to van Hiele theory there are five levels of geometric thinking, which are sequential and hierarchical: recognition (visualization), analysis, abstraction, deduction, and rigor. Research from around the world did several large studies on the van Hiele theory since 1970s (Usiskin, 1982; Senk, 1985). These studies influenced American NCTM Standards and Common Core State Standards. The number of Arab residents in East Jerusalem (2013) is about 305,500 (ir amim, 2016). Arab math education system in East Jerusalem adopted the math curricula of The Palestinian Ministry of Education. This paper focused on van Hiele theory of geometric thinking among Arab pre-serves mathematics teachers from east Jerusalem. We adapted the Arabic version of Usiskin's test (Rasslan, Rasslan-Sharif & Yosif, 2013). The results are extremely not encouraging. Only 31.6% of our sample (N=117 math pre-service teachers) achieved the 3rd level. Levels 4 and 5 are not existed.

**Keywords:** Van Hiele Levels Of Thinking, Geometry, Mathematical Thinking, Mathematics Curricula

## THE VAN HIELE LEVELS OF GEOMETRIC UNDERSTANDING UPON EAST JERUSALEM JUNIOR HIGH SCHOOL STUDENT

*Mahmoud Hadia, Shaker Rasslan*

Geometry is one of the major academic subjects in math curriculum in middle schools and secondary schools. This field of study is perceived as one of the most complicated mathematical fields. Studies conducted in the last twenty years reported on difficulties encountered by students in learning geometry. The main reason for these difficulties is the gap between the level of teaching and learning abilities and understanding of students: students have a low level of geometric thinking, while the teachers are trying to teach them high level knowledge that they have. Pierre and Dina van Hiele develop a theory involving levels of thinking in geometry that students pass through as they progress from merely recognizing a figure to being able to write a formal geometric proof. Their theory explains why many students encounter difficulties in their geometry course, especially with formal proofs. The van Hieles believed that writing proofs requires thinking at a comparatively high level, and that many students need to have more experiences in thinking at lower levels before learning formal geometric concepts. There are five levels, which are sequential and hierarchical. They are: Level 1 (visualization), Level 2 (Analysis), Level 3 (Abstraction), Level 4 (Deduction), and Level 5 (Rigor). The number of Arab residents in East Jerusalem (2013) is about 305,500 (ir amim, 2016). Arab math education system in East Jerusalem adopted the math curricula of "The Palestinian Ministry of Education". This paper focused on van Hiele theory of geometrical thinking among junior high school students. Our sample included 128 students 9th graders from six separated schools, 3 males and 3 females schools from east Jerusalem. We adapted the Arabic version of Usiskin's test (Rasslan, Rasslan-Sharif & Yosif, 2013). The results are extremely not encouraging when it comes to junior students: only 24.8% out of the students in our sample achieved level 1, 4% level 2, 2.3% level 3, level 4 and 5 not existed upon the students involved in our sample.

**Keywords:** Mathematical Thinking, Geometry, Van Hiele Levels



## THE VIEWS OF SEVENTH GRADE STUDENTS TOWARDS STEM

*Riza Başaran*

The aim of this study is to define seventh grade students' views regarding STEM concepts and their interests towards engineering. The study was carried out in a middle school, which was located in Ankara. The study was conducted with 20 seventh grade students. In the study, qualitative research method was benefited as a method and content analysis was used to analyse data of the study. A semi-structured interview form was applied to students, which had six items. According to the data of the study, it was found that the most answers to science was "science" (15,90%); to technology "health (20,45%); to engineering "job" (27,58%); to math "exchange" (33,33%). There have been given some recommendations at the end of the study.

**Keywords:** Content Analysis, Qualitative Research, Stem

## THE VIEWS OF STUDENTS ON THE APPLICATIONS OF DIFFERENT COLLABORATIVE LEARNING METHODS IN GENERAL PHYSICS I COURSE

*Nilüfer Okur Akçay, Kemal Doymuş*

The purpose of this research is to determine the views of the pre-service teachers regarding the applications of the Group Investigation (GI), Reading-Writing-Presentation (RWP) and Learning Together (CL) methods, which are cooperative learning methods used in the teaching of General Physics-I course. The sample of the study consists of a total of 99 pre-service teachers who study at three different branches of the first class of Science and Technology Teaching Department in Faculty of Education, Ağrı İbrahim Çeçen University in the fall semester of 2011-2012 academic year. In the study, Force and Motion subjects were taught for 5 weeks in accordance with cooperative learning methods. The interview technique, one of the qualitative research methods was used in the research. After the end of the application, semi-structured interviews were conducted with each group and 11 questions were asked in the interview and answers of the pre-service teachers were recorded with voice recorder. The content analysis was used in the analysis of the obtained data. As a result, it was concluded that the preservice teachers have positive opinion about the applied methods like the fact that each individual in the group has a task in the methods contributes to them in terms of having responsibility, contrary to the traditional education being active in the classroom, increasing the self-confidence during the course, mediating to establish good friendship for the students, increasing their sharing with each other and providing social addiction and to providing the unsuccessful and inactive students to increase their success, and they have negative opinions like inadequacy of time and the noise which is emerged within the groups.

**Keywords:** Cooperative Learning, Group Investigation, Reading-writing-presentation, Learning Together, Physics.



## THOUGHTS OF SCIENCE TEACHERS ABOUT SCIENCE EDUCATION FOR MAINSTREAMING STUDENTS

*Kevser Kâse, Seyit Ahmet Kiray*

The purpose of this research is to conceive opinion of science teachers and students with normal intelligence when science education is given in the classrooms where students with intellectual disabilities are present. Participants in the research study group are science teachers at secondary school. Semi-structured interview technique has been used in this research which deals with data collection technique. The interview form developed by the researcher as a means of data collection in the research has been finalized in the direction of expert opinions. In this study, science teachers have a similar point of view in terms of the points of view from students with mental disabilities and students with normal intelligence. The research shows that science teachers don't know how to teach students with intellectual disabilities in their mainstreaming classes.

**Keywords:** Students With Intellectual Disabilities, Mainstreaming Student, Science Education, Students With Normal Intelligence, science Teacher

## THOUGHTS OF STUDENTS WITH NORMAL INTELLIGENCE ABOUT LEARNING SCIENCE WITH MAINSTREAMING STUDENTS

*Kevser Köse, Seyit Ahmet Kiray*

The purpose of this research is to conceive opinion of students at the level of normal intelligence about science education with mentally retarded students in their classroom. Participants in this research's study group are students with a normal intelligence level who are study at secondary school. Semi-structured interview technique has been used in this research which deals with data collection technique. The interview form developed by the researcher as a means of data collection in the research has been finalized in the direction of expert opinions. The research revealed that students with normal intelligence levels don't want to study science with students with intellectual disabilities. As a reason; Because they are not at the same level of intelligence as the mainstreaming students and therefore the mainstreaming students are left behind and can't understand the lesson so they prevent course process for normal students. In this study, integration students stated that they are more satisfied with the training of the more successful students in the same class.

**Keywords:** Students With Intellectual Disabilities, Mainstreaming Student, Science Education, Students With Normal Intelligence



## TRAINING FOR IMPLEMENTATION OF MANIPULATION FOR THE TREATMENT OF EXTRINTESTINAL MANIFESTATIONS OF CROHN'S DISEASE

*Volodymyr Sulyma, Olena Sulima*

Establish and implement effective therapeutic techniques for improving the quality of treatment of patients with extraintestinal manifestations of Crohn's disease. For intra manipulation should allocate special tools that not be used for other purposes: 10 ml syringes - 2-5 pcs., needle type Dyufu to dial drugs, injectable needles of different caliber in length from 2 to 8 cm used for intravenous, subcutaneous and intradermal injections, forceps, tweezers. After intra manipulation on knee joints patient is less than 2 hours under medical supervision in a sitting position, avoiding movement in the joint. After puncture joints of the upper limb patient's stay in the clinic is required. Creation of joint relative calm achieved by imposing appropriate scarf bandage on his hand, patients are recommended to take it off yourself 2 hours. In outpatient conditions is strictly prohibited to manipulate intra areas ankle joint, foot joints and areas of the foot because this requires special preparation of the skin, and is performed only in a hospital. 15-years experience of method of intra manipulation in strict compliance with the fixed algorithm indicates the absence of complications and the possibility of its use in the future, which improves the quality of treatment patients with extraintestinal manifestations of Crohn's disease.

**Keywords:** Training, Manipulation, Treatment Of Extraintestinal Manifestations Of Crohn's Disease



## TREATING THE FALLING BODIES PHENOMENON IN MODERN PHYSICS LESSON WITH DIALOGICAL DISCOURSE LINE

*Numan Bademli, Seyit Ahmet Kiray*

The falling bodies phenomenon in physics science is interested in different times by different scientists, and it is still an important issue, that is much debated and need to be explain. Teaching this subject has specific principles and methods like every subjects. The technics used in classroom differ from a discipline to another and even differ from a subject to another subject in the same discipline. In this study, it will be examined how the falling bodies phenomenon within the scope of the Modern Physics Teaching in Science Education will be explained by the functional descriptions for the dialogic discourse and how they are met by the students. Discourse analysis is used as analysis method. Results show that when falling bodies subject is taught on the basis of dialogic discourse, students begin to think higher and begin to learn meaningfully. This study will light on the future and the use of dialogic discourse which is not often encountered today.

**Keywords:** Falling Bodies, Dialogical Discourse, Conceptual Science



## TRENDS IN MASTER'S AND DOCTORAL THESIS IN TURKISH MATHEMATICS EDUCATION: 2012-2017

*Selcen Çalık Uzun, Zeki Aksu, Ümit Kul, Sedef Çelik*

The past is an indicators of the future. The things done in the past assist to shed light on the future and give us a direction. Examining the trends in mathematics education research is thought to be a guide, as it is in every field, for other researchers to direct their work while helping them to plan future studies. In this regard, this study gives an overview of trends in Turkish mathematics education research between 2014 – 2017 classifying of studies based on research design, research topic, sampling, data collection tools, data analysis method. With this purpose in mind, the data collected from dissertations and thesis submitted in Turkish Council of Higher Education Thesis Centre Database were reached. The content analysis was used to collect the data. Thesis classification form was previously developed by Sözbilir ve Kutu (2008) and then revised by Çiltaş (2015) in order to classify mathematics education research. This form consisted of seven sections including general information about publication, learning domains, mathematics topic, research design, data collection tools, sampling and data analysis methods. The analysis process of the data is ongoing.

**Keywords:** Mathematics Education; Thesis And Dissertations; Trends In Mathematics Education; Content Analysis



## USE OF 3D PRINTERS IN EDUCATION

*Serhan Kökhan, Uğur Özcan*

3D printing technology which is the latest trend technology, is possible to use in many areas. Examples include industrial manufacturing, medicine and health, aviation and space, architecture and construction, military applications, textiles, food, education and many other areas. The education title has a strategic

importance for 3D printers. It is seen as an important tool in increasing creativity in interactive, mechanical and technical courses. With the effective use of this technology in the educational environment, different experiences can be experienced in different areas. These areas include Mathematics, Geography, Architecture, Art, Biology, Chemistry, Geology, History, Science and Engineering. Designing, printing and calculating 3D objects in mathematics. Through the use of 3D printer technologies that include many examples of applications such as designing and printing reliefs in geography, designing and printing artistic objects in art education, printing molecular models in biology, explaining challenging concepts to learners, attracting students to participate more effectively in class, classroom interaction may be easier. In this way, students will be able to prepare for their careers and gain valuable skills for the future. In this study, the use of 3D printer in education has been examined.

**Keywords:** 3d Printers, Education



## USE OF CONCEPT MAPS IN ELIMINATING MISCONCEPTIONS

*Sibel Demir Kaçan, Fatma Şahin*

In this study it was aimed to determine the levels of drawing a concept map in order to eliminate the misconceptions of prospective science teachers. In this research, answers to two sub-problems as well as to the main problem were sought in addition. The first sub-problem of this study is related to determining the current misconceptions of the prospective science teachers under the aforementioned titles. The second sub-problem of this study is about determining the prospective science teachers' levels of drawing an accurate concept map. The research was conducted with 3rd year prospective science students, who study at the science education department of a university in Istanbul province. In this study, 40 prospective science teachers studying at university were randomly chosen. The data retrieved from the study were analyzed through content analysis. In content analysis, existing case can be elaborately analyzed through themes and codings, thus the raw data obtained from the study can be examined in depth. Therefore, in this study main themes were created and the data obtained from the study were indicated in frequency based on the themes created. Moreover, in this study we tried to provide examples of the concept maps drawn by prospective science teachers. In the current literature, there are many studies related to the significance of both domains including misconceptions and concept maps. In addition to these studies, this current research was comparatively evaluated and interpreted. For that matter, we tried to present some recommendations, which, we believe, will contribute to the field of science education.

**Keywords:** : Concept Map, Science Education, Misconception, Prospective Teacher



## USING THE DIENES METHOD IN TEACHING UPPER ALGEBRA TO CHILDREN

*Zoltan Zakota, Edith Debrenti*

Zoltán Pál Dienes was one of the leading personalities in the pedagogy of the 20th century who tried the impossible, namely to transform the learning of mathematics, a seemingly not approachable subject for lots of children, into a joyful and creative activity. While traveling around the world, he started several pedagogical experiments on almost all continents being the founder of "new mathematics", an approach to mathematics learning that uses games, songs, and dance to make it more appealing to children. He dedicated his career to the development of mathematical education by traveling throughout the world and spreading his methods on games as efficient means of teaching mathematics. The base idea of his teaching was that learning "serious math" can be started through manipulative tools and games much earlier than it

was thought before. As he used to say: "give me a mathematical structure and I will make a game out of it". He used to affirm that the thought of children under 12 years is basically constructivist, turning into analytic just later, and for this reason it is necessary that construction precedes analysis. In the year of 1968 he held a four-day long workshop in Budapest for children of third grade, during which they studied together geometrical transformations. The workshop was transposed on paper by Tamás Varga and now we made an attempt to remake this experiment and introduce some elements of group theory and upper algebra to children from lower grades. The results of this experiment do constitute the theme of our presentation.

**Keywords:** Mathematics Education, New Mathematics, Zoltán Pál Dienes



## VALIDITY AND RELIABILITY OF ACHIEVEMENT TEST DEVELOPED IN REPRODUCTION, GROWTH AND DEVELOPMENT IN PLANTS AND ANIMALS

*M.handan Güneş, Cahide Serdaroğlu*

This study has been conducted to prove the validity and reliability of the academic achievement test prepared within the achievements of the 6th grade Science lesson 'Reproduction, Growth and Development In Plants and Animals' unit. The test has been prepared in accordance with the outcomes defined in the Science Education Curriculum of the Ministry of National Education, Education and Training Board. At the same time, it has been attached importance to the homogeneity of the distribution of the questions in the test according to the outcomes. Content validity has been examined by four science teachers, two of them are doctoral students, one is graduate student and the other is undergraduate student, and one assessment and evaluation expert and one subject matter expert. One Turkish teacher has made the examination of the test consisting of 40 items in terms of writing and marking rules. Achievement test has taken its shape after the final corrections and necessary analyses have been made by applying it to 170 elementary students. First, the Kaiser-Meyer-Olkin test has been used to determine the suitability of the data for factor analysis. The result has been 0.776. According to the Kaiser-Meyer-Olkin (KMO) test, the sample has been sufficient. As in the classical test theory, 27% of the data have been defined as upper and lower group for item difficulty index and item discrimination index, and KR-20 value has been evaluated for reliability. The internal consistency (KR-20) of the test has been found to be 0.885, while the item difficulty index has been between 0.356-0.889 and the item discrimination effectiveness has been 0.222-0.711. As a result of the received results, there has been no need to distract any item from the test. As a result of all analyses, it has been accepted that this achievement test has acceptable psychometric features and its validity is high.

**Keywords:** Achievement Test, Validity And Reliability, Science, Curriculum, Elementary School



## VISUAL DESIGN IN GEOGRAPHY TEXTBOOKS

*Şuayip Şeyihoğlu, Ayşegül Şeyihoğlu*

While preparing textbooks, it is necessary to apply certain design principles. The purpose of this study is to examine geography textbooks in terms of visual design. Textbooks prepared by the Ministry of National Education for use in high school level geography lessons were analyzed by document review method. As a means of data collection, a Textbook Evaluation Scale was used in terms of visual design. It was also

supported by interviews with findings specialist and graphic design specialists. Obtained findings were described with tables and supported with examples from textbooks. As a result, visual design elements were realized at different levels in books. There are problems in the amount and form of use of some elements, and suitability to the aim.

**Keywords:** Visual Design, Geography Education, Textbook



## WE DON'T TEACH MATHEMATICS BEFORE OUR STUDENTS LEARNING TO READ AND WRITE

*Yilmaz Mutlu*

The purpose of this study is to determine whether part or all of the mathematics course duration is used for teaching reading and writing by teachers in the first semester of elementary school, the reasons if they are used, then whether there are any compensation courses for teaching mathematics, whether the compensation course done is sufficient and how the students are affected by this situation. The study in the context of the stated purpose was carried out with the case study design, which is one of the qualitative research methods. Participants in the study consist of 22 classroom teachers who work in 3 different primary schools. The data were collected using an interview form with five open-ended questions. The obtained data were analyzed by content analysis. After the examinations made, 86% of the teachers stated that they used some or all of mathematics course duration for teaching literacy. The teachers explain the following reasons; the start of the school without the students reaching sufficient maturity, the parents' indifference, crowd of classes, the lack of time, prompting teachers to switch from reading to writing as soon as possible, pressure of school administration and inspectors, parents make classroom teacher difficult by making student, classroom and school comparisons, anxiety about not being able to teach on time. Teachers stated that they were doing compensation classes during the play and physical activity hours, during the 2nd period in the reading and writing hours. Some of the teachers have stated that they do compensation classes for it but the mathematical concepts are not reinforced enough because of not spreading over a wide period of time. This situation cause students have difficulties in mathematics lessons and then have negative attitudes about mathematics and eventually have low mathematics performance in the next years. On the other hand, some teachers have express that the content of the mathematics teaching program can be trained on time with compensations, and that students have no problems. As a result, when the data obtained from the class teachers are taken into account, it can be said that most of the teachers use mathematics course duration for literacy teaching for various reasons and this situation affected the mathematics education in the negative. In this context, it is suggested to carry out action research with the participation of a research group consisting of mathematics, Turkish and classroom educators to solve the determined problem.

**Keywords:** Mathematics Education, Primary Education, Literacy And Mathematics




## WHAT IS HAPPENING TO QR CODES? IS GREEN CRESCENT WEEK BOARD ALIVE?

*Ercan Pehlevan, Gülcan Çetin, Emine Büyükkol Köse, Kübra Kösal*

The aim of this study is to prepare Green Crescent Week Board including application of QR code for elementary school students and to determine the student opinions about this board. In the study, the ADDIE design model (analysis, design, development, implementation and evaluation) and qualitative research approach were used. Board is prepared for 6-8. Grade elementary school students. First of all,

some web sites related to Green Crescent Week have been examined and some texts, pictures and videos compiled for the board from these sites have been enriched with the application of QR codes. Thus, Green Crescent Week Board including application of QR codes was prepared. Later, the board was put on the school corridor and students were asked to examine the board by using a mobile device. 9 students were also interviewed using by a semi-structured interview form. The data were analyzed using content analysis technique.

**Keywords:** Qr Code Technologies, Green Crescent Week Board, Augmented Reality, Mobile Learning



## WHAT MAKES A PROOF, CONVINCING PROOF?

*Fatma Nur Aktaş, Gönül Yazgan-sağ, Esra Selcen Yakici-topbaş, Elçin Emre-akdoğan, Ziya Argün*

A proof can be defined as an argumentation convincing oneself or others who knows about the content (Davis & Hersh, 1981). Weber and Mejia-Ramos (2015) interpreted proof conviction in two ways as absolute conviction and relative conviction. The purpose of this study is to investigate prospective mathematics teachers' (i) definition and intended usage of proof and (ii) interpretations on proof conviction. We have conducted this qualitative study with three prospective secondary mathematics teachers. We have individually interviewed prospective teachers and asked them to identify their views on the definition of mathematical proof and intended usage. Then, we have given them four mathematical statements which include deductive, algebraic and visual proof. We asked follow up questions to reveal their thoughts on the persuasiveness of the proof. The data were coded according to content analysis (Merriam, 2009). The findings have examined according to prospective mathematics teachers' definition and intended usage of proof. While two participants have defined proof as a mathematical argument, the other participant has stated that mathematical statements could also be a proof. The participants that think that theorems or propositions are needed to prove find sufficient to be convinced themselves through proof. The other participant has declared that proof should have persuasive nature. Participants that have absolute conviction for deductive proof, are familiar with deductive proof method. Participants also have defined algebraic proof as a practical method or a type of representation. Visual argumentations are incomprehensible to understand, therefore, they require solution or explanation. Finally, participants have believed that visual proof is (i) not a mathematical proof, (ii) only an explanation or type of representation, and (iii) intuitive and not generalizable.

**Keywords:** Mathematical Proof, Proof Conviction, Absolute-relative Conviction, Argumentation, Prospective Mathematics Teacher.



## WHAT NATURE OF SCIENCE SHOULD BE TAUGHT TO STUDENT SCIENCE TEACHERS? SCIENTISM IN CHINESE SCIENCE TEACHER EDUCATORS' CONCEPTIONS

*Zhi Hong Wan*

There is a long history in Western science education advocating the goal of teaching nature of science (NOS). Recently NOS education is also beginning to find its place in China. An exploratory study investigated Chinese teacher educators' conceptions of teaching NOS to student science teachers through semi-structured interviews. Five key dimensions emerged from the data, among which their conceptions of NOS content to be taught to student science teachers are the most socially and culturally embedded. This paper will focus on illustrating the influence of one prominent aspect of Chinese culture, i.e., scientism, on

this dimension. It is argued that since scientism is still very popular in the developing countries and regions, it may be necessary to anticipate its influence when designing NOS instruction for learners in these areas. Suggestions are also given on making decisions on NOS content to be taught.

**Keywords:** Nature of Science; Scientism; China; Science Teacher Educators; Conception

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## WHY DO WE NEED TO TEACH INFORMATION AND COMMUNICATION TECHNOLOGIES IN HIGHER EDUCATION?

*Zoltan Zakota*

The penetration of higher education by information and communication technologies has radically changed the way students study, interact with the educational system and even understand the world. When it comes about teaching ICT to students, there are several reasons to do it, but first of all, obviously, because it is part of the curriculum and students have an exam to pass. A somewhat more exotic reason is the disenchantment of technology: a highly developed technology is like magic and we have to make students understand that. In some sense we have to inflict a kind of "respect" to modern ICT and all that resides behind it. On the other hand, we have to clarify to them the profane nature of all this technological magic. The educational process has to develop students' autonomy by dismantling the principle of technological authority. This leads, in a fortunate case, to the expansion of rationality and rebuilding of confidence in technology on a different level. Another main objective of the teaching process is to start a transition process from the quantitative way of thinking to the qualitative one, to make students not just to measure, but also to interpret in a pertinent way the results of measuring. And last, but not least, students have to familiarize with the use of alternative ways of thinking, with the fact that complex problems seldom have single solutions. They have to familiarize with handling complexity and optimization. Teaching ICT is not just about familiarizing students with up-to-date technologies, but also about forming a new point of view and helping them to understand the world they are living in. My paper aims to present this process, the way it can be managed and the difficulties encountered while doing it.

**Keywords:** Information And Communication Technologies, Higher Education, Teaching Ict

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## WI-FI HOTSPOT BASED STUDENT ATTENDANCE CONTROL SYSTEM ON ANDROID PLATFORM

*Meltem Kurt Pehlivanođlu, Nevcihan Duru*

In this study a smartphone application that is developed on Android platform ensures controlling the student attendance to the lesson without the instructor effort. For the first registration of the related lesson attendance sheet students use their smartphones which are connected on Wi-Fi (Wireless Fidelity) hotspot then every student is added with their identifying MAC (Media Access Control) addresses to the sheet. Afterwards the next lesson students only connect to the hotspot to join the lesson attendance sheet. In the background just then developed smartphone application compare that MAC addresses of the connecting students to the hotspot with MAC addresses of the first registration attendance sheet. Then matching MAC addresses are added to the daily attendance sheet of the related lesson for verifying the identities of the students who are in the classroom. At the end of the lesson, attendance sheet that is within easy reach can be controlled by the instructor of the lesson using that application on her/his smartphone. Thanks to developed smartphone application instructor does not waste of time and effort taking attendance. It provides efficiency and effectiveness.

**Keywords:** Student Attendance System, Wi-fi Hotspot, Education, Smartphone Application



### COMPARISON OF ACHIEVEMENTS OF DAYTIME AND EVENING CLASS OF MACHINE DEPARTMENT STUDENTS IN INFORMATION AND COMMUNICATION TECHNOLOGY COURSE

*Yasin Akman*

The same topics were explained 74 students in daytime and evening education. In every class, sample applications were made every week on the computer. All of the students done sample applications. The students' errors were corrected one by one. In this way all the courses were more efficiently. After that, all students were tested on the same questions. In this study, I aimed to compare the teaching method and the achievements of the students. As a result, I observed that success of evening education students were less than the daytime education students approximately 3,34% points.

**Keywords:** Achievement, Achievement Comparison, ICT



### COMPARISON OF SUCCESSES OF FIRST AND SECOND EDUCATION OF MACHINE DEPARTMENT STUDENTS IN FOREIGN LANGUAGE COURSE

*Yasin Akman*

There are differences between students that first and second education students in Turkey. Huğlu vocational high school has machine department. The vocational high school has first and second education programs and consists of 41,33 students respectively. All second education students stopped their education at least one year after their high school graduation. The same subjects were explained in foreign language lesson. The first and second education students were tested with same questions at the same time. I examined each answers given by the students. I aimed to compare the successes of the students in this study. As a result, I observed that first education students were 2.8 percentage points more successful than second education students.

**Keywords:** Achievement Comparison, Foreign Language, First And Second Education



### THE EXAMINATION OF SCIENCE TEACHERS' ATTITUDES TOWARDS EDUCATIONAL RESEARCHES

*Munise Seçkin Kapucu*

Scientists conduct many educational researches about various topics to improve the quality of the education. On the other hand teachers are expected to apply the findings of these researches into practices. The attitude of the teachers towards these researches plays an important role on the usage of the results of educational researches. The research was designed according to scanning model. Scanning model, which allow the determination of the current situation, was used because it was descriptive type. 137 science teachers who voluntarily participated in the study. The distribution of the teachers according to discipline was: 48 physics teachers, 33 chemistry teachers and 56 biology teachers. The scale used in the study to determine the attitude of the teachers towards educational researches was "Attitude towards

Educational Researches Scale (AERS)", which is a 5-points Likert type scale developed by İlhan, Şekerci, Sözbilir and Yıldırım (2013). The validity and reliability tests of the scale were performed by İlhan, Şekerci, Sözbilir and Yıldırım (2013). Arithmetic mean, standard deviation, percentages, t-test and one-way variance analysis were used to analyze the data obtained within the study. According to the result of the analysis, it has been found that the mean scores obtained from the dimensions of AERS did not differentiated according to gender, type of the secondary education, and attended trainings.

**Keywords:** Science Teachers, Attitudes Towards Educational Researches Scale, Scanning Model



## THE RELATIONSHIP BETWEEN THE SCIENTIFIC EPISTEMOLOGICAL BELIEFS AND THE PERCEPTIONS OF SCIENCE AND PSEUDOSCIENCE OF THE PRE-SERVICE SCIENCE TEACHERS

*Munise Seçkin Kapucu, Zeynep Oymak*

The aim of this study is to examine the relationship between scientific epistemological beliefs, and perceptions of science and pseudoscience of the pre-service science teachers regarding to a variety of variables. The sample of the study consists of 200 pre-service teachers studying at the science department of the faculty of education at a state university in 2016-2017 academic year. As a Sampling method, convenience sample from non-random sampling methods was used in this study in order to determine which teachers to work with from the available sample. Relational screening model was employed in this study. "Scientific Epistemological Beliefs Survey" and "Science-Pseudoscience Distinction Scale" are the assessment instruments in this research. Data will be analysed according to descriptive statistics, t-test, ANOVA and correlation. The findings of the study will also be examined in terms of gender, education level of parent, class level and whether they take the course called nature of science and the relationship between the scientific epistemological beliefs and the perceptions of science and pseudoscience of the pre-service science teachers. Recommendations will be put forward considering the results of the study.

**Keywords:** Scientific Epistemological Beliefs, Science-pseudoscience, Pre-service Science Teachers

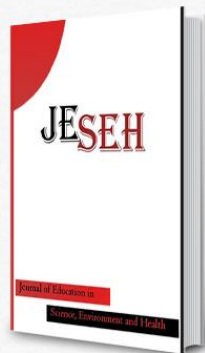




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