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Educational Research and Reviews

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ARTICLES

Full Length Research Paper

Observing the technological pedagogical and content knowledge levels of science teacher candidates

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This study was planned to observe the technological pedagogical and content knowledge of teacher candidates. The study group consists of 4th grade students of Firat University Faculty of Education who were asked to describe any desired topic in the secondary school science curriculum, using the methods and techniques of their choosing. Teacher candidates talked about topics they had chosen in front of their peers with micro teaching technique. During this process, teacher candidates were evaluated by themselves, their peers and teachers using an observation form in terms of their ability to use methods and techniques, mastery of field knowledge and ability to integrate technology into the course. In the study, partially mixed concurrent equal status design was used. Technological pedagogical and content knowledge survey was used for the quantitative data and the qualitative data of the study were obtained from observation forms filled by the researchers of the study, teacher candidates and their peers. The results showed that the teacher candidates had a moderate level of technological pedagogical content knowledge. The fact that the pre- and post-study scores were significantly different in favor of the posttests suggests that it is important for teacher candidates to have the opportunity to make self-evaluations. It is very important for the teacher candidates to attend the courses where they can evaluate their technology, pedagogy, and content knowledge (TPACK) competencies especially in their teacher training programs and to make up for their deficiencies without starting to their professional life.

Key words: Technology, pedagogy, and content knowledge (TPACK), micro teaching, science teacher candidates.

INTRODUCTION

The rapid changes in information, communication and technology in the 21st century have made the use of technology in the learning and teaching process inevitable in order to increase productivity and quality in education (Selim et al., 2009; Ekici et al., 2012). As a result of the need for technology, information technologies have been integrated with learning environments, and it has become involved in the

education system (Ekici et al., 2012, Tabach, 2011). The integration of technology into educational activities has gained importance, and teaching and learning opportunities have been offered in classrooms prepared for both teachers and students so that easy and quick access to technology and learning materials can be provided (Doğan, 2012). Effective use of technology offers students a deep comprehension of concepts in a different and meaningful way, increasing the learning levels of students and contributing to the efficiency and permanence of education (Doğan, 2012, Selim et al., 2009).

The development of technology has enabled new models and approaches to be developed. One of these is the technology, pedagogy, and content knowledge (TPACK) approach, which has been added to the literature by the addition of technology knowledge by Mishra and Koehler (2006). The TPACK framework builds on pedagogical content knowledge developed by Shulman (1986). TPACK is an approach that is integrated with knowledge of technology, content knowledge, and pedagogical methodology specific to content, where technology integration knowledge will not be confined to technology courses alone. Teachers should improve their content knowledge by incorporating technology, and to acquire teaching skills by including technology in the process (Kopcha et al., 2014; Aygün et al., 2016).

There are three types of knowledge which are technology knowledge (TK), pedagogy knowledge (PK), and content knowledge (CK) in the TPACK model. In addition, the model has three components of knowledge: technological pedagogical knowledge (TPK), technological content knowledge (TCK) and pedagogical content knowledge (PCK) (Koehler and Mishra, 2005; 2008; 2009; Mishra and Koehler 2006; Shin et al., 2009). The seven knowledge constructs are explained below (Mishra and Koehler 2006):

Technology knowledge (TK): This knowledge includes a variety of technologies used in learning environments from blackboard to advanced technologies.

Pedagogy knowledge (PK): This knowledge refers to procedure, practice, or methods necessary for teaching and learning like as general classroom management strategies, course planning, and student assessment.

Content knowledge (CK): Content knowledge is about the subject to be learned or taught. Teachers must know and understand the topics that are taught, including knowledge of facts, concepts, theories, and procedures that are specific to a particular area such as math, biology, and history.

Technological pedagogical knowledge (TPK): It is needed to understand general pedagogical strategies applied to the use of technology, and to understand how

teaching and learning will change with use of certain technologies. Teachers need to exceed these technologies and associate them into instruction.

Technological content knowledge (TCK): In this knowledge it is important to integrate the technology into teaching. Content knowledge need to be supported using technological equipments.

Pedagogical content knowledge (PCK): PCK deal to teaching knowledge feasible to a certain subject area. Teachers need to adapt instructional materials to know the students'wants.

Technological pedagogical and content knowledge (TPCK): TPCK is the intersection of the three knowledge bases.

The seven components of TPACK is shown in Figure 1. The studies about the use of TPACK in teacher education have increased in recent years to measure TPACK (Schmidt et al., 2009; Archambault and Barnett, 2010; Koh et al., 2010; Sahin, 2011; Fisser et al., 2015; Kartal and Afacan, 2017; Drummond and Sweeney, 2017), to examine the information communication technologies (ICT) and TPACK integration (Öztürk, 2012; Chai et al., 2014; Yurdakul and Çoklar, 2014; Tondeur et al., 2015; Gür and Karamete, 2015; Ersoy et al., 2016; Kihoza et al., 2016; Koh et al., 2017; Kontkanen et al., 2017), for exploring teachers' technological pedagogical content knowledge (Hsu et al., 2013; Delen et al., 2015; Dong et al., 2015; Boschman et al., 2015; Phillips, 2017; Turgut, 2017), to examine TPACK and teachers' self- efficacies (Kazu and Erten, 2014; Kenar et al., 2015; Saudelli and Ciampa, 2016; Blonder and Rap, 2017), to determine TPACK and needs of Twenty-First-Century Education (Mishra, Koehler and Henriksen, 2010; Koh et al, 2015; Cherner and Smith, 2017).

Studies on TPACK emphasize that in addition to field content knowledge, a good teacher should know how to transfer this knowledge to his or her students (Canbazoğlu et al., 2010, Bilici, 2012). Voogt et al. (2013) in their literature review found that student-teachers do get experience in the design of technology-enhanced lessons but lack experiences in enacting technology based lessons. When we consider that technology integration is also an integral part of effective and efficient education, it is expected that teachers should improve their technological knowledge related to their current field content knowledge and their ability to use technology adequately in the teaching process (Gencosman, 2015; Khine et al, 2017).

Work in the field of TPACK in Turkey started in 2010, and the studies carried out in this field have increased over the years. In the studies conducted, the samples consisted mostly of teacher candidates while the samples of few studies consisted of teachers. However, it has been reported that mixed groups consisting mainly of
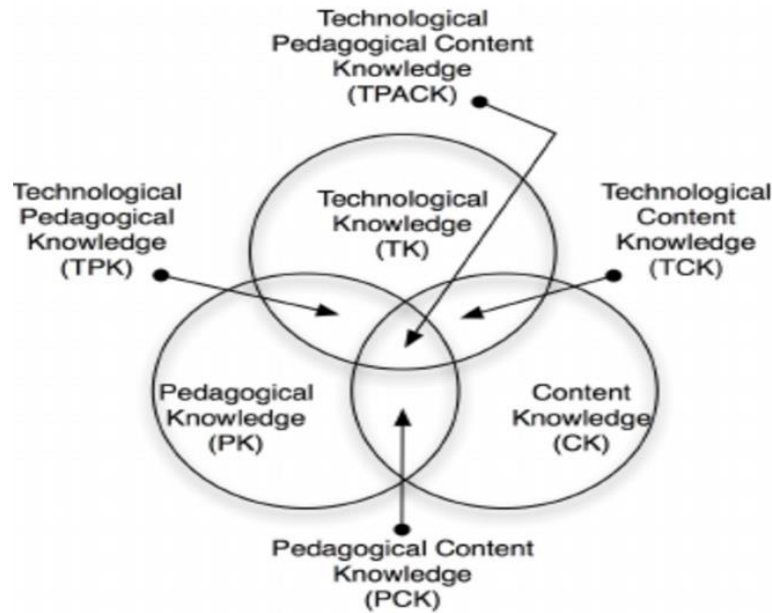
Figure 1. Technological pedagogical content knowledge (TPACK) (Mishra and Koehler, 2006).

more than one discipline were selected as the sample, and the most frequently studied fields after mixed groups would be listed as mathematics teachers, classroom teachers and science teachers (Baran and Bilici, 2015).

If we look at some of the recent studies conducted in the field of TPACK in Turkey; Aygün et al. (2016) in their study conducted on teacher candidates, found that the teacher candidates had a low level of competence in applying the teaching method and technique used in the teaching of the subject area through technology, and that the lectures were mostly made by presentations even though the activities prepared by the teacher candidates were intended to encourage discovery.

A total of 154 teacher candidates attending 2nd, 3rd and 4th years of college participated in a study aiming to determine the self-confidence of preschool teachers about their TPACK. The data were collected and analyzed using the TPACK self-confidence scale. According to the results of the study, it was found that the perceptions of the teacher candidates about their TPACK self-confidence were high, but there was no significant difference according to the gender and grade level of teacher candidates (Sancar et al., 2013).

In their study, Açıkgül and Aslaner (2015) aimed to determine the TPACK confidence levels of mathematics teacher candidates who were studying in different grades and to determine whether these confidence levels differed according to some variables. As a result of the TPACK confidence scale applied to 527 teacher candidates, it was found that candidates were highly confident of their TPACK. There was no significant difference in terms of computer ownership, frequency of

use and level of use of technology, while there was also no significant difference according to gender and grade levels of candidates.

Kartal and Afacan (2017) in their study found pre-service science teachers' TPACK levels develop in direct proportion to their grade level. In many studies carried out with teacher candidates or teachers in the field of TPACK, many subjects such as self-evaluation levels of TPACK in the sample group, investigation of TPACK in terms of some variables, investigation of TPACK confidence perceptions, and TPCK self-efficacy are frequently encountered (Canbolat, 2011; Demir and Bozkurt, 2011; Bilici, 2012; Öztürk, 2013; Bal and Karademir, 2013; Akyüz, 2016; Aygün et al., 2016).

According to Mishra and Koehler (2008), while being an important part of the integration of technology in education, teachers need to be aware of technology, pedagogy and content knowledge about effectively and efficiently integrating technology into their lessons, as well as the knowledge structures generated as a result of the interaction of these with each other. Evaluations and discussions on education in Turkey have become more and more frequent in recent years, and they are among important current topics. Our ministry is undertaking breakthroughs and reforms in many fields in education in order to be able to raise young generations equipped for the constantly changing country and world conditions.

Undoubtedly, teachers are the most critical factor in these breakthrough and reform efforts. The most important role of change in the field of education belongs to teachers, no effort that teachers cannot embrace and internalize has been successful and these innovations

are not reflected to the classroom environment. It is highly important to identify the TPACK levels of teacher candidates who will educate younger generations, and to eliminate existing shortcomings, enable them to graduate with a high TPACK, and to provide suitable environments for them to make use of information and communication technologies in their professional life. The prospect of teacher rearing emerges when a teacher candidate with a high self-sufficiency is considered to be more successful in his professional life and more willing and determined to solve it than a problem. When we consider that a teacher candidate with high self-efficacy has more success in professional life, is more willing and determined to solve an encountered problem, the importance of the responsibility of teacher training becomes evident.

Similarly, the successful integration of technology into the teaching process depends on the technology knowledge of teachers and their self-efficacy in using technology. This study was planned to observe the TPACK of teacher candidates. Teacher candidates were asked to describe any desired topic in the secondary school science curriculum, using the methods and techniques of their choosing. Teacher candidates talked about topics they had chosen in front of their peers with micro teaching technique. During this process, teacher candidates were evaluated by themselves, their peers, and teachers using an observation form in terms of their ability to use methods and techniques, mastery of field knowledge and ability to integrate technology into the course. The scores given are explained together with their reasons. The data obtained without this study is thought to be the answer to the following questions. The scores given were explained with their reasons. The data obtained in this study is thought to provide answers to the following questions.

Determining which methods and techniques teacher candidates choose will allow us to have an idea of what kind of strategy they will pursue in their future professional lives. In addition, knowing their mastery on the method they choose will give information about the proficiency of teachers in pedagogical terms. The topics that teacher candidates choose from the science curriculum, and identifying the grade level and discipline (physics, chemistry, and biology) that these topics belong to will provide us with an idea of the field competencies of the prospective teachers. We believe that this study will be useful in determining the reasons for the low level of success of the content knowledge examinations of teacher candidates, which is one of the teacher induction criteria in Turkey since 2013. We also believe that this study will answer the questions of whether teacher candidates use technology during the lecturing process, if so which technological tool do they use, the method they employ and how and at what level they integrate technology to their content knowledge. This study aims to observe the level of teacher candidates' technological pedagogical content knowledge according to components.

METHODOLOGY

In the study, Partially Mixed Concurrent Equal Status Design, where qualitative and quantitative data collection tools are used together was used. Leech and Onwuegbuzie (2009) have suggested that design should be used in concurrent applications with a two-stage design where the quantitative and qualitative components have equal weight. In the process of using the mixed method, all the characteristics of both quantitative and qualitative approaches must be known in depth and be actively used throughout this process (Çepni, 2014).

The study group consists of 4th grade students of Firat University Faculty of Education, 39 female and 7 male a total of 46 teacher candidates. TPACK survey was used for the quantitative data of the study. The qualitative data of the study were obtained from observation forms filled by the researchers of the study, teacher candidates and their peers. TPACK surveys are mostly preferred in the studies (Schmidt et al., 2009; Koh et al., 2010; Şad et al., 2015). In this study, TPACK survey was used, with a likert type of 5, from 47 items and 7 sub-dimensions, which was developed by Şahin (2011). The survey items are answered by means of a Likert-type scale with five response choices, including "1=not at all," "2=little," "3=moderate," "4=quite," and "5=complete."

Observation form was formed by the researchers with the suggestion and participation of the teacher candidates. The observation form was examined by 5 science educators and decided to be suitable for use in the study. Teacher candidates are asked to evaluate their peers in terms of content knowledge, pedagogical knowledge and technological knowledge competencies and to score a maximum of ten points. Teacher candidates were asked to indicate the reasons of the points given.

FINDINGS

Qualitative and quantitative data of this study carried out with mixed pattern are given below.

Qualitative data

In this study, teacher candidates explained the topics they had chosen in front of their peers with the micro teaching technique. In this section, the data obtained from the observation forms were analyzed in terms of method and technical knowledge, content knowledge, and technology knowledge based on self, peer and teacher evaluations.

Observation form analysis of teacher candidates according to content knowledge

Teacher candidates have chosen the subjects they want from the science curriculum, and presented them with micro teaching method. Teacher candidates were scored while they were presenting their chosen topics by their peers, and five lecturers were present as observers. After the teacher candidates finished their presentation, they

Table 1. Teacher candidates' self-, peer- and teacher-assesstments in terms of content knowledge

Variable	Min score	Frequency (f)	Max score	Frequency (f)	Mean
Self-assesstments	5	1	10	28	9.37
Peer- assesstments	6.4	2	10	1	8.28
Teacher-assesstments	5	2	10	2	7.89

Table 2. Distribution of selected topics according to the information learning discipline.

The information learning discipline	5th grade	6th grade	7th grade	8th grade	Total	Percentage
Living creatures and life	12	3	4	3	22	47.9
Physical events	3	0	4	2	9	19.6
Matter and change	2	0	3	5	10	21.7
The world and the universe	3	0	1	1	5	10.8

watched their own videos and evaluated themselves. Tha data gotten from the scores of the prospective teachers' assessments, the topics selected, the class level in which these topics take place and the distribution of topics' learning discipline are presented in the tables below. Teacher candidates' self, peer and teacher assessments in terms of content knowledge are given in Table 1.

Teacher candidates' self-evaluation mean scores (9.37), peer evaluation mean scores (8.28) and teacher mean scores (7.89) are presented in Table 1. When the self-assessment scores are examined, it is found that a large rate of teacher candidates (61%) gave themselves the highest grade (max=10) that can be taken. It is shown that there is a significant difference between teacher assessment and self-assessment mean scores. The peer assesstment scores are between the self and teacher assesstment scores but they are closer to the teacher assesstment scores.

Table 2 shows the distribution of the topics selected by the teacher candidates in the micro-teaching practices according to the information learning discipline indicated in the Elementary Education Institutions Science Curriculum (2013). As shown in Table 2, "*living creatures and life*" learning discipline is the most selected learning discipline with 47.9% of the teacher candidates. The rate of preference for other learning disciplines is 21.7% in *matter and change*, 19.6% in *physical events* and 10.8% in *the world and the universe*. The topics selected by teacher candidates and the grade level in which these topics take place is indicated in Table 3.

According to Table 3, the teacher candidates mostly preferred the subjects at the 5 th grade level. The 6th grade subjects were least selected. The most selected units of living creatures and life learning disciplines were the units about human body subjects (n=15). Environmental subjects were also preferred by teacher candidates (n=7). The most preferred subject of the teacher candidates under the physical event learning

discipline was the friction force (n=3). Under the matter and change learning discipline, the most preferred subject is the matter and change unit topics (n=10).

Observation form analysis of teacher candidates according to pedagogy knowledge

Teacher candidates presented their chosen topics with a method and technique they wanted with micro teaching method. Teacher candidates were graded in terms of their dominance of the methods and techniques by their peers and 5 teachers who participated in the lesson as observers. After the teacher candidates finished their presentation, they watched their own videos and evaluated themselves. The scores that teacher candidates receive from these evaluations are given in Table 4. Table 4 examined teacher candidates' self-assessment mean scores (9.34), peer assessment mean scores (8.46) and teacher assessment mean scores (7.89). When the self-assessment scores are examined, it is shown that a large rate of teacher candidates (61%) gave themselves the highest grade (max=10) that can be taken as content knowledge.

Observation form analysis of teacher candidates according to technology knowledge

Teacher candidates are required to integrate the selected topics, method and technique they desire with technology. Teacher candidates were evaluated by their peers and their teachers in terms of technology knowledge. Teacher candidates' self, peer and teacher assessments in terms of technology knowledge are given in Table 5. Table 5 shows teacher candidates' self-assessment mean scores (9.06), peer assessment mean scores (7.45) and teacher assessment mean scores

Table 3. The topics selected by teacher candidates and the grade level in which these topics take place.

Grade level	Unit	Subjects	Frequency	Total
5th grade	Let's solve the puzzle of our body	Digestion of nutrients	n=1	20
		Smoking and alcohol harm	n=1	
		Nutrients and their properties	n=4	
	Let's explore the world of living	Global warming	n=2	
		Human and environment relation	n=2	
		Let's recognize the living	n=2	
	Measuring the magnitude of force	Frictional force	n=3	
	Change of matter	Matter and characteristics	n=1	
		Heat-temperature	n=1	
	The mystery of the earth's crust	Environmental pollution	n=3	
6th grade	Systems in our body	Support and movement system	n=1	3
		The circulatory system	n=1	
		Respiratory system	n=1	
7th grade	Systems in our body	Sense organs	n=1	12
		Organ donation and organ transplantation	n=1	
		Controller and regulatory system	n=1	
		Digestive system	n=1	
	Reflection and absorption of light in the mirrors	Mirrors	n=1	
	Solar system and beyond	Solar system	n=1	
	Matter and properties of the matter	Domestic waste and recycling	n=1	
		Grain structure of the matter	n=2	
	Force and energy	Mass and weight	n=1	
		Pressure	n=2	
8th grade	Human growth and development	Mitosis and meiosis	n=1	11
		Genes	n=1	
	Living and energy relations	Biotechnology	n=1	
	Earthquake and weather events	Climate	n=1	
	Electricity in our lives	Electric loads	n=1	
	Simple machines	Simple machines	n=1	
		Matter and characteristics	n=3	
	Structure of the matter	Periodic table	n=1	
		Acids and bases	n=1	

Table 4. Teacher candidates' self-, peer- and teacher-assesstments in terms of pedagogy knowledge.

Variable	Min score	Frequency (f)	Max score	Frequency (f)	Mean
Self-assesstments	7	3	10	28	9.34
Peer- assesstments	6.4	1	10	1	8.46
Teacher-assesstments	4	3	10	5	7.89

Table 5. Teacher candidates' self-, peer- and teacher-assesstments in terms of technology knowledge.

Variable	Min score	Frequency (f)	Max score	Frequency (f)	Mean
Self-assesstment	5	3	10	28	9.06
Peer- assesstment	4.2	2	10	1	7.45
Teacher-assesstment	2	1	10	3	7.10

Table 6. Descriptive data of TPACK survey pretest and posttest scores.

Subscales	N	Pretest		Posttest	
		Mean	SD	Mean	SD
TK subscale	46	3.43	0.58127	3.59	0.58461
PK subscale	46	3.28	0.36493	3.47	0.61022
CK subscale	46	3.33	0.39277	3.72	0.43158
TPK subscale	46	3.39	0.38963	3.69	0.59204
TCK subscale	46	3.42	0.43420	3.78	0.50719
PCK subscale	46	3.35	0.46729	3.65	0.54606
TPACK subscale	46	3.35	0.48842	3.73	0.55250
TPACK scale	46	3.08	0.34630	3.72	0.46393

Table 7. t-test results of TK, PK, CK subscales and TPACK scale pretest-posttest scores.

Measurement	N	$\bar{X}$	SD	df	t	p
TK subscale pre-test	46	51.3913	8.71902	45	-2.413	0.020
TK subscale post-test	46	53.891	8.76921	45	-	-
PK subscale pre-test	46	19.6957	2.18957	45	-2.198	0.033
PK subscale post-test	46	20.8043	3.66133	45	-	-
CK subscale pre-test	46	20.0435	2.24060	45	-5.112	0.000
CK subscale post-test	46	22.3043	2.58946	45	-	-
TPACK scale pre-test	46	141.8696	15.92986	45	-11.493	0.000
TPACK scale post-test	46	170.9565	21.34058	45	-	-

(7.10). When the technology knowledge self-assessment scores are examined, it is found that 61% of teacher candidates gave themselves a full score just like content knowledge and pedagogy knowledge.

Quantitative data

In this section, the data of the scores obtained from the TPACK survey of the prospective teachers were analyzed. The TPACK survey consists of likert type 47 items and seven subscales including TK, PK, CK, TPK, TCK, PCK, and TPACK. It was examined whether the pre-test and post-test scores of the teacher candidates met the normality assumption. TK, PK, and CK subscales and pre-posttest scores of the TPACK scale fulfilled the normality assumption, and pre- and posttest scores of the TPK, TCK, PCK, TPACK subscales did not meet the normality assumption. Related sample t-test for scores meeting the normality hypothesis was analyzed, and using wilcoxon signed rank test for scores that did not meet normality hypothesis. Pretest and posttest mean scores and standard deviations showing the TPACK levels of teacher candidates are given in Table 6. When TPACK scale pre-test and post-test mean scores of teacher candidates are examined, it was found that post-test scores increase. However, it is indicated that the

level of proficiency in the posttest mean scores is at the middle level as it is in the pretest scores. t-test results of TK, PK, CK subscales and TPACK scale pretest-posttest scores are given in Table 7. The results suggest that there are significant differences in the mean scores of technology knowledge subscale'pre-test and post-test scores (t(45) =-2.413, p < 0.05); pedagogy knowledge subscale subscale'pre-test and post-test scores (t(45) =-2.198, p < 0.05); content knowledge subscale subscale'pre-test and post-test scores (t(45) =-5.112, p < 0.05) and TPACK scale TPACK scale' pre-test and post-test total scores (t(45)= -11.493, p< 0.05). Pretest and posttest scores of TPK, TCK, PCK and TPACK were analyzed using the Wilcoxon signed rank test. The results are shown in Table 8. When Table 8 is examined, it is found that there is a significant difference between pretest and posttest scores of TPK, TCK, PCK and TPACK subscales of preservice teachers (p<0.01).

Conclusion

When TPACK scale pretest and posttest averages of teacher candidates are examined, it is found that there is an increase in post-test scores. This result shows that teacher candidates observing their peers like critics over the course of one term, and evaluating their peers and

Table 8. Wilcoxon signed rank test results of TPK, TCK, PCK and TPACK subscales' pretest and posttest scores

Variable	Posttest-pretest	N	Mean rank	Sum of ranks	z	p
TPK subscale	Negative ranks	7	10.86	76.00	-3.396[*]	0.001
	Positive ranks	24	17.50	420.00	-	-
	Ties	15	-	-	-	-
TCK subscale	Negative ranks	7	12.93	90.50	-3.839[*]	0.000
	Positive ranks	29	19.84	575.50	-	-
	Ties	10	-	-	-	-
PCK subscale	Negative ranks	5	15.10	75.50	-3.936[*]	0.000
	Positive ranks	30	18.48	554.50	-	-
	Ties	11	-	-	-	-
TPACK subscale	Negative ranks	7	9.79	68.50	-3.807[*]	0.000
	Positive ranks	26	18.94	492.50	-	-
	Ties	13	-	-	-	-

[*] Based on negative ranks.

themselves through the observation form have a positive effect on technological pedagogical content knowledge. The results of the paired sample t test and wilcoxon signed rank test showed that there was a significant difference in favor of the posttest scores in the TK, PK, CK, TPK, TCK, PCK, TPACK subscale scores and in the overall scores of the scale. However, it is found that the level of increase in the average of the posttest scores is at an intermediate level as it is in the pretest scores. When the relevant researches are examined, the results are in parallel with the general results of this research (Gömleksiz and Fidan, 2011; Sancar et al., 2013; Şad et al., 2015). The fact that teacher candidates more frequently being in learning environments where they are authentically evaluated as in this study will carry this level higher.

Teacher candidates were graded by themselves, their peers and their teachers in terms of their content knowledge, via the observation form. It was found that teacher candidates were not able to objectively evaluate themselves during self-evaluation. With an extremely high ratio of 61%, teacher candidates gave themselves a full score and expressed their content knowledge to be very good. This result is inconsistent with the results of teacher evaluation. Teacher candidates were left free on the topic selection, and thus they were given the opportunity to choose the topic they felt most competent in. Despite this, there were only two teacher candidates that received a full score in teacher evaluations, while this number was only one in peer evaluations.

Almost half of the teacher candidates chose the subject of "living creatures and life" learning domain. The rate of preference for other learning domains is below 25%. The reasons for the preference of living creatures and life

learning domain may include teacher candidates having more content knowledge in this discipline, having a better attitude towards the discipline of biology, and seeing themselves to be more competent in this discipline. It is important to identify the reasons for this tendency of teacher candidates in terms of increasing their content competencies. We also believe that investigating the KPSS questions –a field examination where teacher candidates need to be successful before being inducted– that are answered correctly according to learning domains, and checked whether they are in accordance with the findings of this study, and taking the opinions of the candidates into consideration will contribute to the literature.

It is found that the teacher candidates prefer fifth grade topics with a frequency of 43.5% in topic selection. One of the reasons for teacher candidates to concentrate on 5th grade topics may be that candidates think fifth grade topics are easier to understand. Interestingly however, only 3 teacher candidates selected 6th grade topics, while other teacher candidates selected 7 and 8th grade topics. When the topics choices of the teacher candidates were examined, it was shown that the topics about the human body were selected the most. The second most selected topic was the 'structure and change of matter', which is under the 'matter and change' learning domain.

According to the results of the 2017 KPSS Teaching Content Knowledge Test (TCKT), the lowest average score of teacher candidates was found to be Science/Science and Technology with an average score of 11,777 (ÖSYM, 2017). In order to increase the content competencies of teacher candidates, we recommend determination of the topics that they do not feel competent in and making improvements in these areas.

Candidate teachers properly using the method they choose, and their communication with students was evaluated under the heading of pedagogical knowledge. The teacher candidates were objective in their self-evaluation forms with regard to pedagogical and technological knowledge, as this was the case for content knowledge, and they gave themselves the highest possible scores.

According to teacher evaluation, the average score of teacher candidates was 7.89, while the average score according to peer evaluation was 8.46. For technology knowledge, average scores of teacher evaluation was 7.10, while the average score of peer evaluation was 7.45. When we consider that teacher candidates prefer the method that they know best, it is thought provoking that the number of students who received the full score in pedagogical knowledge is n=5, and for technological knowledge is n=3. That is to say, while the teacher candidates felt competent, they were not found competent when they were evaluated by their teachers.

On the observation forms, scoring was done on a scale of ten points, and it was found that the scores were in proximity with the scores obtained from the TPACK scale when the teacher candidates were evaluated by their teachers on a scale of five (content knowledge=3.95, pedagogy knowledge=3.95, and technology knowledge=3.55). The quantitative and qualitative data obtained in the study showed that the teacher candidates had a moderate level of technological pedagogical content knowledge. The fact that the pre- and post-study scores were significantly different in favor of the posttests suggests that it is important for teacher candidates to have the opportunity to make self-evaluations. It is needed to develop the teacher candidates'effective specific level of TPACK in their subject area (Khine et al., 2017).

Teacher candidates do not have the opportunity to be in an implementation environment where they can evaluate their TPACK competencies until the school experience and teaching practice lessons in their final year. In this case they are too late to overcome the shortcomings in the fields and pedagogical topics that they find themselves to be incompetent.

Thomas et al. (2013) suggest TPACK into teacher education programs to measure implementation through evaluation and research. Teacher preparation programs is needed to transform into fully realized TPACK environments. The competencies of teacher candidates should be increased through micro teaching practices similar to those in this study. With an increase in the number of such studies, it can be ensured that teacher candidates evaluate themselves more objectively.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Educational Research and Reviews

Full Length Research Paper

Predicting effective course conduction strategy using Datamining techniques

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Data analysis techniques can be used to analyze the pattern of data in different fields. Based on the analysis' results, it is recommended that suggestions be provided to decision making authorities. The data mining techniques can be used in educational domain to improve the outcome of the educational sectors. The authors carried out this research study by devising a mathematical model and tool to determine effective course conduction strategy, for teaching the students regression analysis and goodness of fit test. This helps the faculty to take necessary remedial actions to improve performance in courses by selecting effective course conduction based on the students' performance. The accuracy of prediction in this research is more as it is measured by using Rsquare value which is near to one.

Key words: Data mining, educational data analysis, course conduction strategy, outcome based education.

INTRODUCTION

Large and increasing amount of data enhance the use of data analysis tools to discover regular and irregular pattern of data. Data mining field is growing up as a discipline in which tools can be used to analyze data, reveal undiscovered knowledge and provide automated decisions in different domains. One of the domains in which data mining is used is education domain, which is called educational data mining.

The main purpose of educational organization is to improve the quality of teaching and learning, making the outcome of education effective and stakeholders satisfied. The main purpose of this research work is to propose efficient statistical and data mining models for improving outcome based education. In educational domain, the need for analysis and prediction of

students' performance is increasing.

In this paper, a data model is proposed and tested to prove the effectiveness of their usage in educational domain. As institutions are moving with the main goal of outcome based education, it has a plan to improve outcome based education. This can be fulfilled using recommendation system, which can help the students and faculty by providing valuable suggestions to attain outcome based education. The challenge faced related to this research is: To study and analyze performance of students and determine better course conduction strategy.

The study aims to find the trends in teaching and learning and their outcome. The analysis is done using R programming language where chi square goodness of fit

test is applied to determine and analyze the effectiveness of active learning strategies, used in courses. After the students go through the active learning of a course and take up the Internal and external examinations, they give us a clear scope for evaluation and comparison of outcome of the active learning strategies.

LITERATURE REVIEW

Data mining applications are enormously getting used in education domain, to improve the performance of the students. Researchers have scientifically investigated data of educational domain using data mining; thus, the outcome of the education will be improved.

Data mining is useful in providing recommendations to improve the businesses by analyzing the business data. In this paper, the authors used statistical and data mining techniques to provide recommendations for improving the outcome of education, by analyzing educational data. The learners' behavioral pattern can be mined using data mining, and different levels of recommendations can be produced using recommender systems.

The recommendation system is designed to provide individualized recommendations to students and to improve their learning effectiveness (Huebner). Predictive assessments tools are used to assess the gap between known and unknown knowledge of students during a professional programme. For this purpose, the predictive assessment tool analyzes students' performance in exams.

Projects are used to provide information to teachers, to let them determine which pedagogical techniques are effective in providing better learning style, during teaching by personalizing learning (West, 2012). Teaching and learning through visualizations improve the engagement of students' learning. Improvements in active, collaborative and student centered learning can be achieved through visualization systems with higher engagement levels in class rooms. That will in turn increase the attainment levels of course outcomes (Laakso et al., n. d.).

Data mining model can be designed to acquire and store data around instructors which are collected from different data sources. Using the data mining model of different classification algorithms, knowledge about instructors can be obtained. For this, different classifiers are trailed and best classification algorithm is found out to get the best prediction results. Then the patterns of instructor data are mapped to generate rules using best classification algorithm to predict instructors' performance and provide recommendation to improve instructors' performance (Ola and Palaniappan, n. d.).

Problem statement

The authors wish to analyze the performance of the

students who have gone through different teaching strategies (Hernandez et al., 2015). The study is aimed at teaching trends followed to deliver same course for two different batches. Analysis of students' performance comparison is done using R programming where chi square goodness of fit test is applied to analyze the impact of different course conduction strategies.

Further, authors did analysis which helps the course conduction faculties to determine which course conduction strategy is better. Here an experimental study is done to analyze impact difference in students' performance under various course conduction strategies. The same data analysis can be used in a scenario where the same faculty has conducted the same course for two different batches of students, using same course conduction strategy.

There, to compare the performance of batches or to compare the effectiveness of faculty, the same analysis can be used. If the students' performance is graded down, recommendation has to be provided to faculty about the degradation of students' performance. If two different faculties have used same course conduction strategy for two different batches, then to compare their effectiveness the same analysis can be used. So, based on that the recommendation can be provided to faculty whose students have performed low.

If a faculty is teaching the same course consecutively then her/his effectiveness can be predicted for forthcoming batch. For this, the students' batches performance has to be gathered and analyzed for whom recently the faculty has taught the same course. The analysis and prediction is done using R programming tool. And the authors have designed a tool for this analysis in python, to perform the analysis in user friendly manner and to provide recommendations.

Proposed method for comparative analysis of course conductions strategies using chi square goodness of fit test and regression analysis

The effectiveness of course conduction strategies can be analyzed primarily based on students' performance in examinations. The education paradigm is shifted from teacher centered model to learner centered model. Students have the responsibility for learning process in actively engaged in upgrading his/her knowledge. The responsibility of teacher in learning process is to guide and facilitate, to make sure the learning goals are attained properly.

The evaluation strategy is not only evaluating the knowledge but including the learning process also. For this, the theoretical courses are accompanied with practical exercises and the feedback received from learners, thus the active learning can be improved. Educators prefer the learning process of theoretical courses with laboratory activities using the process of
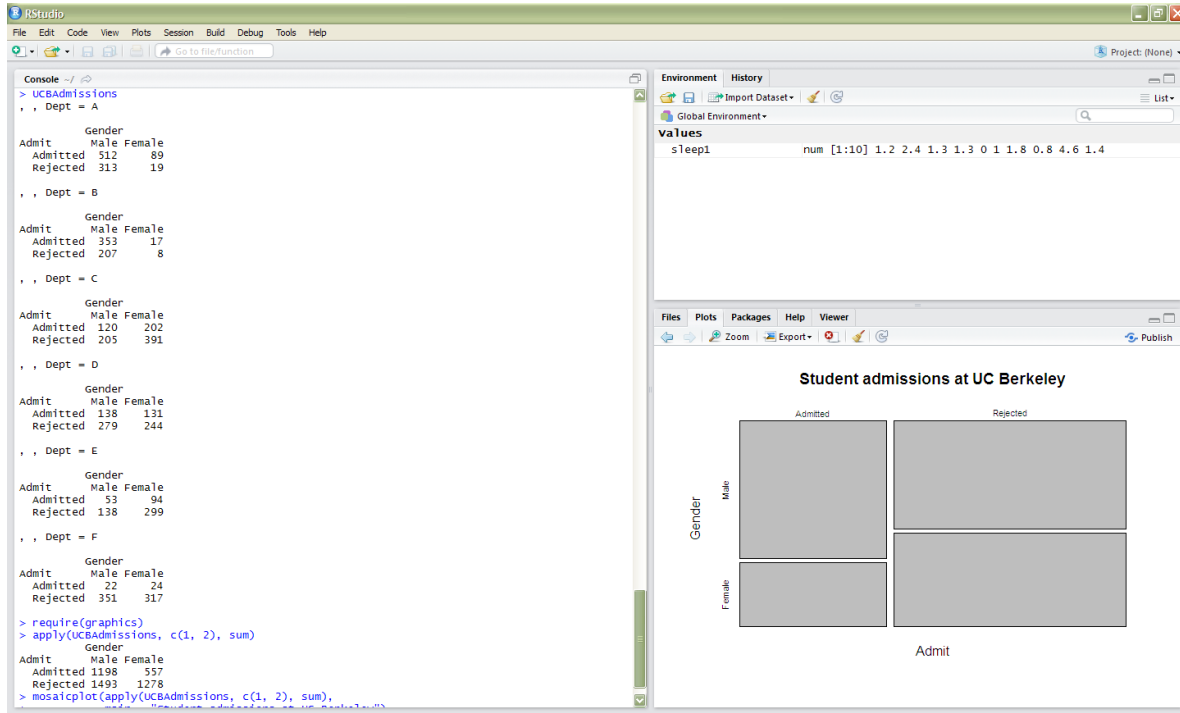
Figure 1. R studio workspace.

learning by doing. The learning effectiveness of different strategies can be analyzed by comparing examination results of different batches, where different course conduction strategies are used accompanying various active learning methods in conducting classes.

For that, the students' performance in active learning tasks, continuous internal assessments and semester end examinations can be collected and analyzed to identify better course conduction strategy. The authors have focused on the study by focusing on this aspect using R programming to determine the significance of the different course conduction strategies and to identify the better strategy based on students' performance. These authors have designed a tool for giving recommendations using python.

R programming

R programming is used for modern statistics. R has more statistical packages. Data can be arranged using variables of columns and rows.

R helps to do different kinds of functions like manipulation, statistical modeling and graphics. Extensibility is a greater advantage of using R. Addition on packages can be easily developed using R programming. R is a good programming language to perform all varieties of statistical analysis for practitioners and researchers.

Using R, the statistical analysis like linear and nonlinear modeling, classical statistical tests, time-series analysis

and clustering and classification analysis can be done (The R Project for Statistical Computing, n.d.). R environment provides the following facilities (Why use the R Language?, n.d.): Effectively handling data and storage facility of data, data structures, handling of missing data, suitable operators to perform calculations on arrays, Intermediate data analysis tools collections, graphical representation of data analysis, input, output , conditional, looping and user defined functional statements.

R studio

R studio is an integrated development environment (IDE) for R programming language. This IDE provides a console and editor supports syntax highlighting. R studio provides facility to debug code, execute code and tools for plotting. This IDE eases the management of workspace. R studio includes workspace browser and data viewer.

This IDE brings our workflow all together with powerful authoring and debugging as shown in **Error! Reference source not found.**. R studio provides facility to integrate the tools, the authors use with R into single environment. Rapid navigation to files and functions can be easily done in R studio. Support for authoring html, pdf, word and slides are available with R Studio. Interactive graphics support is also provided in R Studio (Take control of your R code, n.d.).
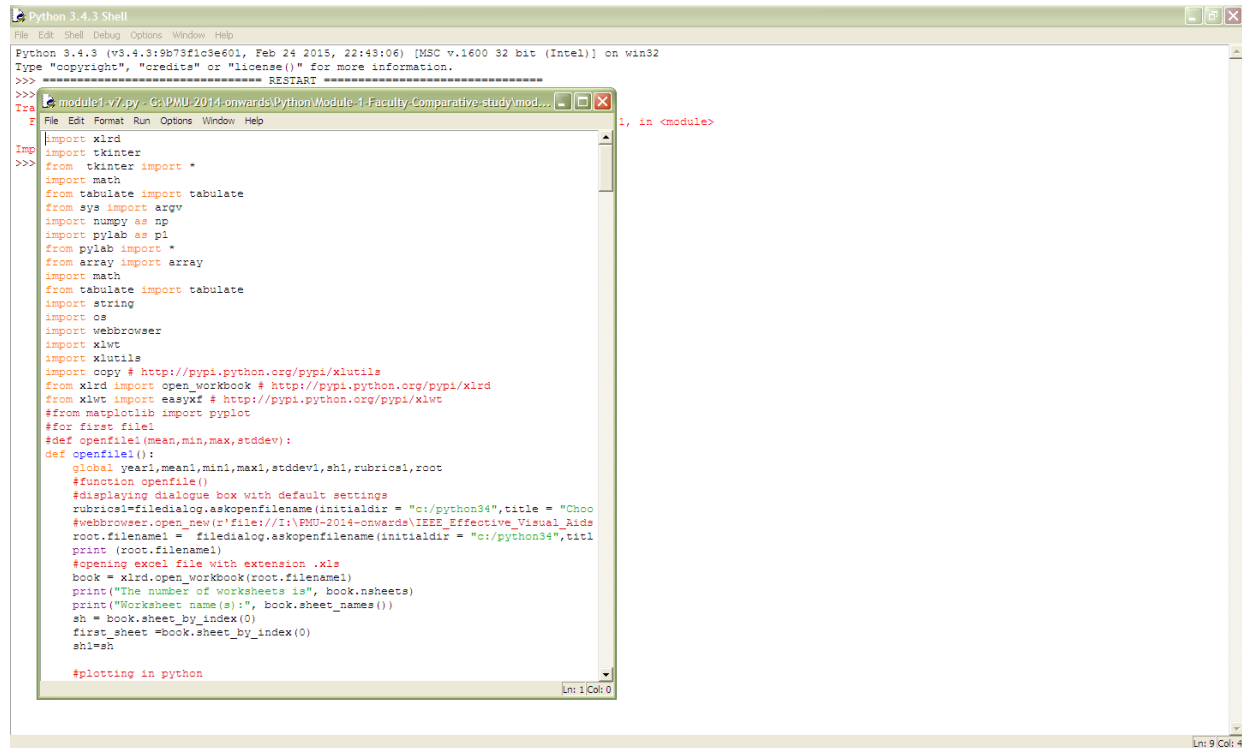
Figure 2. Python workspace.

Python

Python programming language is a dynamic object oriented programming language. Programmer can integrate many technologies using python, thus the productivity in software development life cycle can be efficient. It is available for most operating systems. It provides extensive support libraries and provides facility to work with different data formats. Numeric and scientific applications can be developed using numeric python and scientific python (Benefits of Python, n.d.).

Python can be used as scripting language to customize or extend the applications as shown in Figure 2. Python packages are useful to develop good quality graphical user interfaced applications as shown in Figure 3. This language has agile nature so the rapid development of prototype is easy. Python is an open source, so contributors from all over the world are working on improvising the designing and extending the features of python.

Problem formulation

Study objective

The comparative analysis of different strategies followed in conducting course helps the teaching faculty to draw some useful conclusions and decisions. In this study, the authors have made an experimental attempt to analyze the variations in trends for conducting courses.

Implementation details for predicting better course conduction strategy

The predictive frequency is obtained in the following equation:

PFR=TSRS*TSPD/TSAD where
PFR is Predictive frequency in particular mark range;
TSRS is Total number of students in different mark ranges under a single course conduction strategy;
TSPD is Total number of students in a particular range under different course conduction strategy;
TSAD is Total number of students in all mark ranges under different course conduction strategy;

System architecture

Consider S is the system which describes student dataset that is, set of data items with students' performance details in same course under different course conduction strategies.

This course level performance data set is the input to our system for statistical analysis and goodness of fit test to identify the better course condition strategy for a
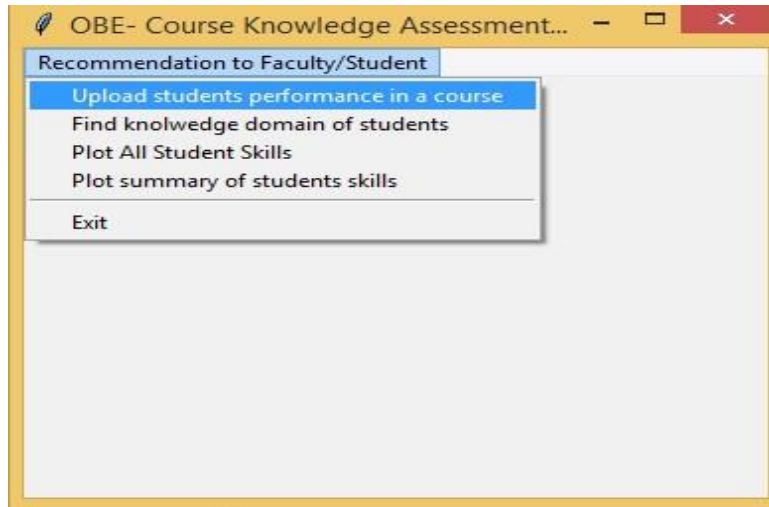
Figure 3. GUI developed using python.
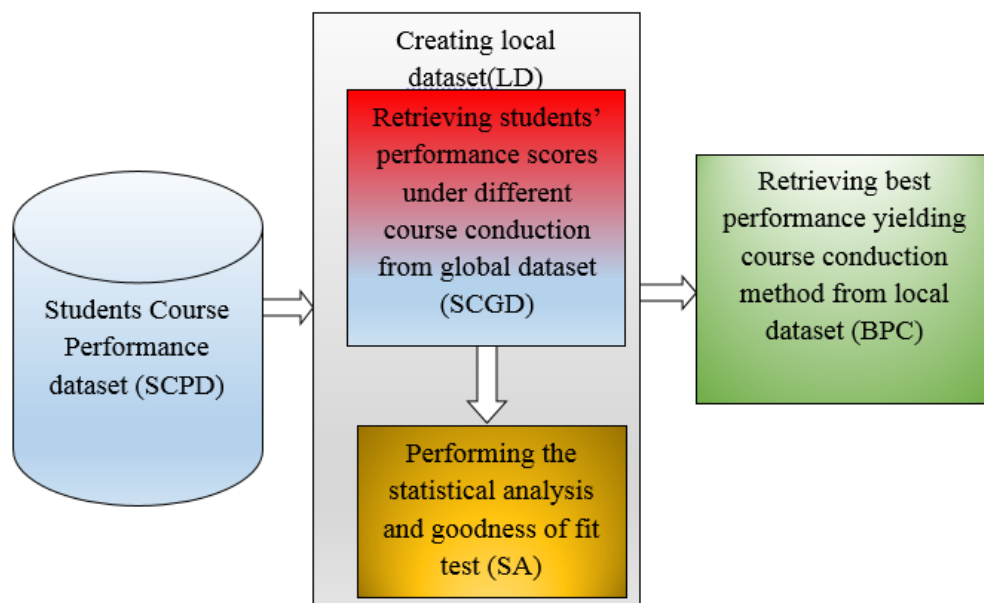
Figure 4. System for predicting better course conduction strategy for a course mathematical model.

course. Then creating the local data sets is done to predict the better course conduction strategy (Figure 4)

Variables

S=(SCPD,LD,SCGD,SA,BPC)
SCPD=Students courses Performance dataset;
LD=Creating local dataset;
SCGD=Retrieving students' performance scores under different course conductions from global dataset;

SA= Performing the statistical analysis and goodness of fit test;
BPC= Retrieving best performance yielding course conduction method from local dataset;
CCSA=Course conduction strategy analyzer;
SCP= Students' course performance details.

Inputs

SCP={PD$_1$,PD$_2$,SD}
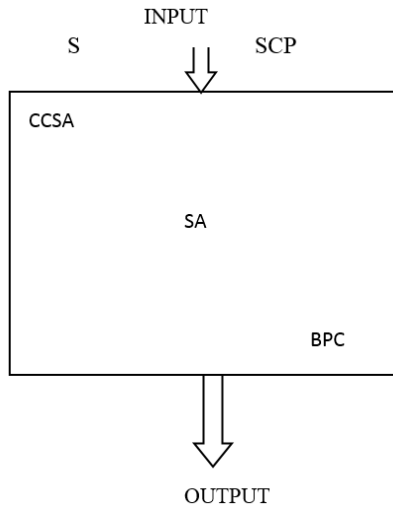
Figure 1. Mathematical Model for predicting better course conduction strategy for a course approach

Where students courses performance dataset, $PD_1=\{P_{11},P_{12},P_{13},\ldots P_{1N1}\}$ is a set of items and for each performance item P_{1id1} $(1<=id1<=N1)$ has a unique id, called P_{id1} where 'N1' is the number of students offering a course using course conduction strategy method-1.
$PD_2=\{P_{21},P_{22},P_{23},\ldots P_{2N2}\}$ is a set of items and for each performance item $P2_{id2}$ $(1<=id2<=N2)$ has a unique id, called P_{id2} where 'N2' is the number of students doing a course using course conduction strategy method-2.
$P_{ji}=s$ where s is the marks scored by i-th student in a course and j =id1 or j=id2
Statistical Data $=SD=\{SD1,SD2\}$
SD1= {mean, standard deviation, max, min} of PD1
SD2={mean, standard deviation, max, min} of PD2

Process

$$CCSA= \overset{2}{\underset{i=1}{U}} [PD_i = \overset{n_i}{\underset{k=1}{U}} P_{ki}]$$
(1)

$$SA= \overset{2}{\underset{i=1}{U}} [SD_i = \{mean(PD_i),stddev(PD_i),max(PD_i),min(PD_i)\}]$$
(2)

(3) BPC = max (SA1,SA2) (Figure 5).

The course conduction strategies can be compared with respect to the students' performance in internal tests and semester end exams. Analysis of students' performance attained under different course teaching and learning strategies makes the faculty to follow or improvise certain course conduction methodology.
 To identify the significance of various course conduction methodologies, the authors find out the

students' performance in different mark ranges. Then, the authors performed chi square goodness of fit test to analyze whether the different teaching learning process made an impact over the students' performance or not.
 For this study, during the last three years, the authors used different teaching and learning strategies for the following courses: Data structure with C, System software and Compiler design. The authors used different active learning and collaborative activities to improve students' learning. Then the authors collected students' performance under different course conduction for same course and did the comparative analysis. The activities carried out for this study consist of the following steps:

(1) Collection of data
(2) Preparation of data
(3) Preprocessing the data
(4) Processing the data
(5) Results and analysis

In this study, the authors considered an engineering organization, MS Ramaiah institute of Technology. The authors made use of data set in ".csv" format. It contains a batch of 154 students' performance in Continuous Internal Evaluation for a course. For instance, they consider the years 2013 and 2014. A sample of the dataset prepared for this study is shown in Figure 6 (Table 1).

Collection and preparation of data

Preprocessing of data

A faculty, who wants to take decision about course conduction strategies, analyzes the historical data of students' performance, which are obtained from Institution's examination repository. In this stage data are identified, gathered, cleaned and aggregated into a format needed for our data models. Here, the missing values are filled with "A" to represent absent.

Processing data (Mining the data)

Data mining technique – Chi square goodness of fit test is applied here to analyze whether the course conduction methodology has influenced the students' performance in internal and external exams or not. Chi square goodness of test is one of the oldest and most well-known methods of statistical analysis. It is the process of statistical test used to compare observed data with the data.
 The authors expect to obtain with respect to a specific hypothesis. By measuring the deviations which are the differences between observed and expected, the authors can conclude that something other than chance is at work, making the observed to vary from expected. The chi square goodness of fit test is called testing null
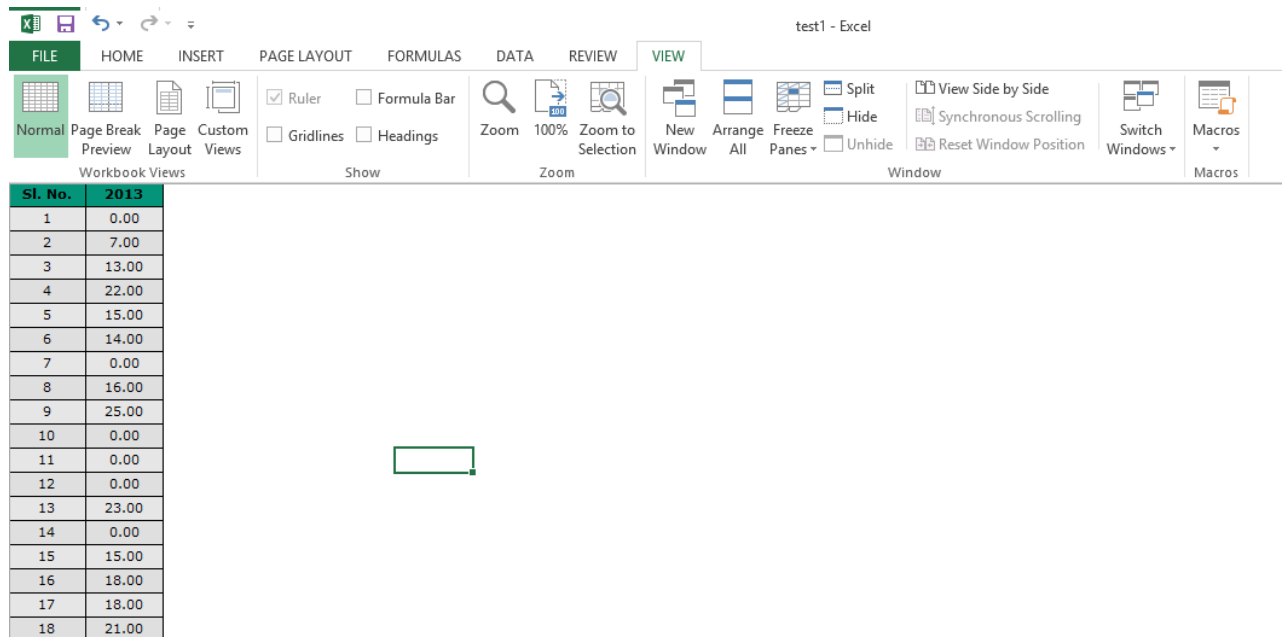
Figure 2. Sample data set.

Table 1. Structure of data.

S/N	Attribute name	Type	Description
1	Roll No	Number	Roll Number of student
2	Marks	Number	Marks scored by student

hypothesis which states that between the expected and observed results there are no significant results. In R studio the authors can work with any number of attributes. There are various packages which help us to perform useful statistical analysis over our data sets to determine the attribute nature of dependency or independency.

The data are configured into the 'Comma Separated Values' using 'Microsoft Excel' node. The students' performance is accepted using R script. Students in different ranges are measured for two different batches of two different course conduction strategies. Then expected frequencies are calculated to find variance from observed frequencies of students' performance to measure chi square value. The p-value significance level is used to determine whether the students' performance in different ranges of different batches is independent of course conduction strategy or not.

Analyzing students' performance

The dependency nature of students' performance in different ranges is analyzed to obtain useful results as seen in the next section.

Results and discussion for comparing course conduction strategies using chi square goodness of fit test

Reports

In this study, the authors get many reports which are valuable assets. The chi square goodness of fit test begins with measurement of predictive frequencies. The predictive frequencies are formed based on students' performance in different ranges under different course conduction strategies. After the measurement of predictive frequencies, a variety of measures of statistical significance such as chi square and significance level of p-value are included. The predictive frequency is obtained in the following equation:

PFR=TSRS*TSPD/TSAD where;
PFR is Predictive frequency in particular mark range;
TSRS is Total number of students in different mark ranges under a single course conduction strategy; TSPD

Performance comparision of course conduction strategies
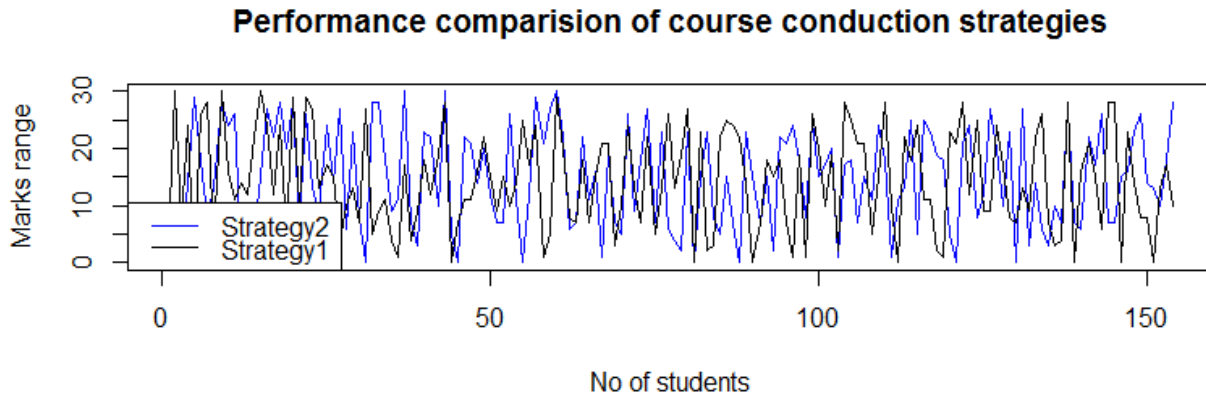
Figure 3. Performance comparison of students.

```
> Students_Count_Mark_Range
          [0,5] (5,10] (10,15] (15,20] (20,25] (25,30]
strategy1   30     28      28      19      28      21
strategy2   26     32      25      19      28      24
```

Figure 8. Students' count in different marks range.

is Total number of students in a particular range under different course conduction strategy; TSAD is Total number of students in all mark ranges under different course conduction strategy.

Based on this aforementioned equation, predictive frequencies measured for students' performance in different marks ranges are obtained. The variations of these predicted frequencies and observed (original) frequencies are shown in the form of R programming graphs (Figure 8).

Performance comparison of students using basic statistical analysis in Python

For performance, comparison of two different course conduction strategies, basic statistical analysis is performed over the performance data sets of students. The comparative analysis of students performance is shown in Figure 7a.

That is why we get the line graphs which are similar, without much variation, and show the performance of students achieved by two different course conduction methods are similar. Number of students are shown in x axis and the students marks are shown in Y axis.

The numbers of students using strategy 1 and 2 in different marks ranges are shown in Figure 8. The number of students scored between 0 to 5 mark range under course conductions trategy1 is 30; with strategy2 it is 26. Similarly, for other ranges also the comparison is

shown in the same Figure 8.

In Figure 9, the predicted students count for each marks range is shown for strategy 1 and 2. As this prediction is based on the past history performance obtained through strategy1 and 2, the predicted results for both strategy are same.

Performance comparison of students under different strategies using chi square goodness of fit test in R programming

For chi square goodness of fit test, predicted frequencies are measured based on students' performance of two different batches and two different course conduction strategies. The comparative analysis of students' performance of a course conductions strategy and predicted performance are shown in Figure 10. The performance comparison graph shows the data points from original dataset that is explored along with predicted data points using chi square goodness of fit test. This helps us to get a quick view over accuracy and predictive nature of model. The data point locations are shown along the x-axis with respect to mark range in y-axis (Figure 11).

Linear regression analysis of students' performance

Students' performances are analyzed using linear regression analysis with respect to original observed

```
> Predicted
            [0,5]  (5,10] (10,15] (15,20] (20,25] (25,30]
Strategy 1  28      30      27      19      28      23
Strategy 2  28      30      27      19      28      23
```

Figure 9. Students predicted count in different marks range using strategy1 and 2.
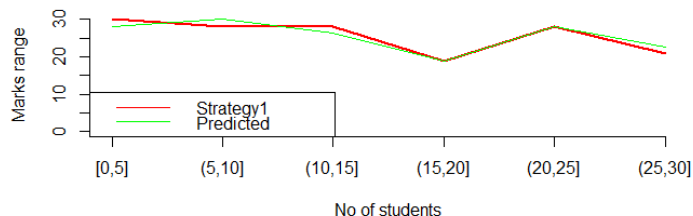
Figure 10. Performance comparison of students' performance under course conduction strategy1 and predicted performance.
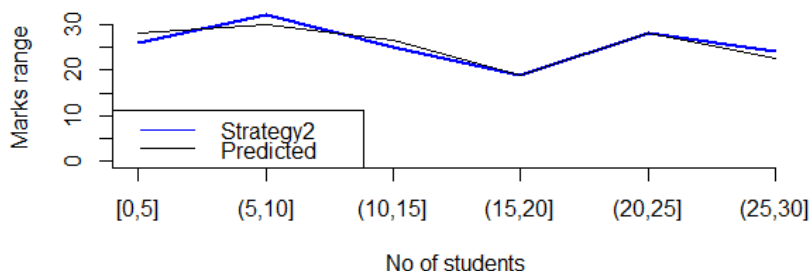
Figure 11. Performance comparison of students' performance under course conduction strategy 2 and predicted performance.

performances and the predicted performances.

Performance analysis of students using Linear Regression analysis

The predicted performance versus original performance of students using course conduction strategy1 shows all the performance data points of original dataset that are explored along with performance data points that would have been predicted using the model produced. This helps us to have overall view about the accuracy and predictive power of model. The original performance dataset of strategy1 is shown along x-axis and the predicted performance data set is shown along the y-axis (Figure 12).

Similarly, the predicted performance vs original performance of students using course conduction strategy2 can also be analyzed using Linear Regression

analysis model as shown in Figure 13.

Prediction accuracy

The R-Square values are used to determine the accuracy of predicted students' performance. If the R square value is nearer to '1' it represents that the prediction is accurate. The R square value obtained for the predictions of two strategies performances are 0.80 and 0.73. The variations occur to some extent due to the institutions' intake of candidates' knowledge level (R tutorial, 2016). The performance using strategy1 vs strategy2 of student can also be analyzed using Linear Regression analysis model as shown in Figure 14.

Conclusion

In this study, the authors carried out this research study
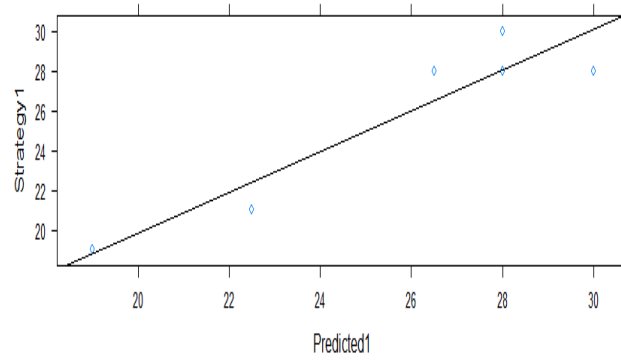
Figure 12. Predicted performance vs performance of students under course conduction strategy1 using Linear Regression.
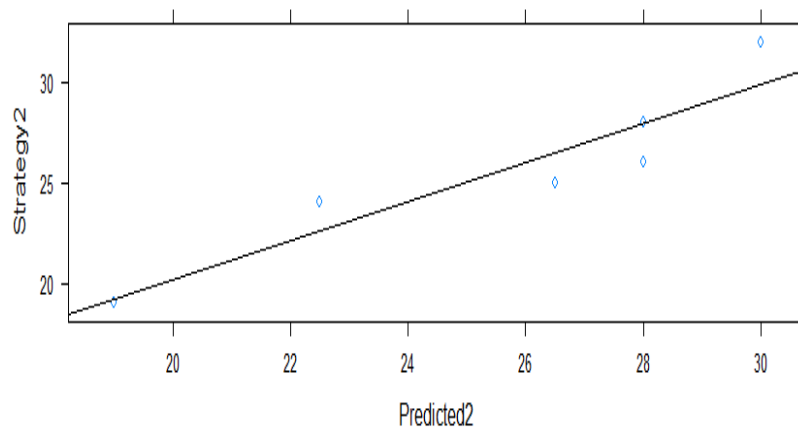
Figure 13. Predicted performance vs performance of students under course conduction strategy2 using linear regression.
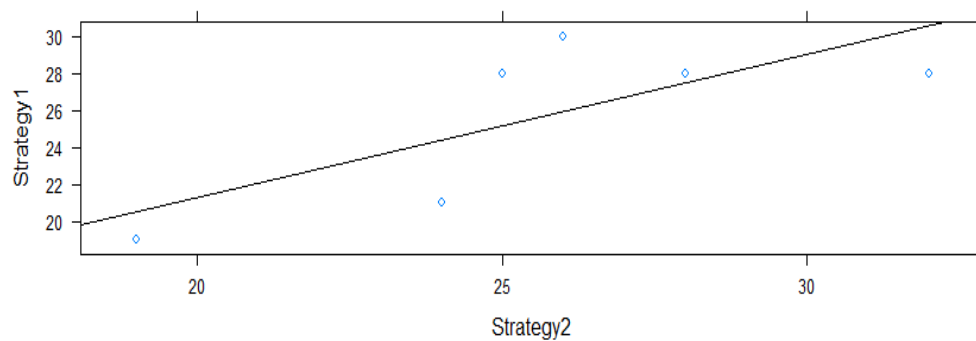
Figure 14. Performance of students under course conduction strategy1 vs strategy2 using linear regression.

to determine the effective course conduction strategy for a course based on students' performance using regression analysis and goodness of fit test. This helps to identify the better course conduction strategy by

comparative analysis of students' performance in internal and external examinations. Based on the analysis, results remedial action can be taken to improve students' performance by updating or improvising the course conduction strategies.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Full Length Research Paper

Unpacking instructional strategies of early childhood teachers: Insights from teachers' perspectives

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Even though previous research points to the significance of early childhood teachers' practices that take into consideration the nature of children and how they learn, there is limited research regarding how instructional strategies impact children's development in diverse ways. To close this gap in literature, a qualitative multi-case study into the perceptions and classroom practices of four kindergarten teachers in two Ghanaian schools, Tata and Kariba, was carried out over a six-month period. One research question guided the study, namely, which instructional strategies do teachers use in a kindergarten classroom? Data used were semi-structured individual interviews and pair-based interviews and fieldnotes of classroom observations. Both within and across case interpretative analysis, as was used. The findings of this study revealed these teachers believed that instructional strategies impacted children's development in different ways; they pointed to play-based instruction and integration as well as specific strategies such as picture-walk and think-pair-share that they believed promoted effective teaching and learnng in kindergarten classrooms which in turn, enhanced and promoted children's multiple intelligencies in terms of socio-emotional, physical, cognitive and language development.

Key words: Childhood, qualitative, cognitive, play, integration, kindergarten, instruction, strategies.

INTRODUCTION

Little research has been carried out in the area of instructional strategies teachers use in early childhood settings. Although, there are multiple studies dealing with issues such as effectiveness of developmentally appropriate practices (DAP) (Eisenhart, Cuthbert, Shrum, Harding, 1988; Elkind, 1989; Hayson, Hirst-Pasek and Rescorla, 1996; Jones and Guldo, 1999; Epstein, 2007), teachers' practices in kindergarten classrooms, (Hyson, Hirsh-Pasek and Rescorla, 1990; Maxwell, MacWilliam, Hemmeter, Ault and Shuster, 2001; Hedge and Cassidy, 2009), and teachers' beliefs and practices (Charlesworth et al., 1993; McMullen et al., 2005; Hedge and Cassidy, 2009b; Parker and Neuhart-Prichett, 2009; Abu-Jaber et al., 2010; Sakellariou and Rentzou, 2011; Riojas-Cotez et al., 2013), there are few empirical studies that identify specific siginiance of one instructional strategies for children's development over the other. Moreover, previous studies focused on how teahers beliefs influenced their choice of intructional strategies. However, the current study explores how the instructional stategies outlined in the kindergarten curriculum inpact children' development. To enhance and promote effective

teaching and learning in early childhood settings, this gap in early childhood literature must be filled.

Instructional strategies contribute to effective teaching and learning in early childhood classrooms, which in turn, impacts children's development in diverse ways. In an effort, to identify the impact of instructional strategies on children's development, past research focused on integration and play-based pedagogy (McMullen et al., 2005), which revealed that play impacted children's cognitive and socio-emotional development. But because of the quantitative nature of the study (Marshall and Rossman (2016), the literature is almost silent on details regarding the impact of these strategies as well as others enhance, promote and improve children's holistic development in early childhood settings. Consequently, there is an incomplete picture with respect to how these stategies impact children's development. A nuanced study is therefore, needed to unearth these subtleties.That is, the current research attempts to employ a qualitative research approach to identify specific instructional strategies and how they impact children's development in Ghanaian kindergarten settings in diverse ways because some of the strategies are designed to addresss specific developmental needs of children but they are under-researched. Against this background, the purpose of this research is to answer the research question: "What instructional strategies do teachers use in a kindergarten classrooms?"

Theoretical framework

Cognitive constructivist theory (Piaget, 1951) and sociocultural theory (Vygotsky, 1978) informed the research. The theories of Piaget (1972) and Vygotsky (1978) are referred to as the cognitive constructivist theory of learning and sociocultural theory of learning respectively. While the former's version of constructivism sees the child as a solitary learner, who constructs knowledge within a social setting, the later perceives the learner as someone who constructs knowledge within a social context through the collaboration with others. Since these theories which are related to DAP, constitute the basis of constructivist principles of teaching in early childhood classrooms, they have been invoked to frame the current study. First, from birth to two years, Piaget argue that children are at the sensory motor stage when they develop perceptual and tactile senses. Second, from two to seven years' children are within the pre-operational stage when they are likely to make use of visual images or picture imagery and words to represent their thoughts. This finding gives us insights into the kindof instructional strategies that are appropriate for developing intellectual skills of young children in early childhood settings. Vygotsky (1978) further argues that children's intellectual abilities are broadened via play and reflections on their actions during early childhood years. As children engage in play activities, they emulate adult

examples. The impact of play on children is succinctly expressed by Vygotsky (1978) when he asserts that "In play, a child is always above his average age, above his daily behaviour, in play, it is as though he were a head taller than himself" (p.129). Thus, children through play emulate socio-culturally defined activities which have been set aside solely for older people in society. Play creates a platform for children's intellectual development because play activities that children create stem from real life issues that they encounter daily in their environment. However, by incorporating implicit rules into their play activities, children tend to learn the basics of abstract thinking (note: children's play has different interpretations; dramatic play, free play, onlooker play, solitary play, associative play, parallel play, and cooperative.

The paper has three parts. First, the research methoddology are presented and data analysis techniques are discussed. Next, the findings are duscusssed. The paper concludes with a discussion of theoretical implications and future directions for further research.

METHODOLOGY

Participants

The study consisted of 4 participants (Kate and Sophia from Tata School; Ramatu and Akotia from Kariba School) purposively sampled from two kindergarten classrooms sited in different socio-economic contexts within the Cape Coast Metropolis, Ghana. Kate, has taught for 25 years while Sophia has taught for 19 years. Ramatu has taught for, 9 years, Akotia on the other hand has taught for 7 years. While both Kate and Sophia have bachelors' degrees in early childhood education, Ramatu and Akotia on the other hand, have diploma in early childhood education. A multi-case qualitative study approach was used in this study because there is need to establish the differences regarding teachers' practices in Tata School and Kariba School sited in different socio-economic settings.

Instruments

Two main instruments were used for this study. These included semi-structured interviews and observations. The interviews made it possible for the researcher to gain insights into participants' perspectives about their practices in kindergarten classrooms. The participants were interviewed in pairs once and individually twice. Interviewing teachers in pairs provided a platform for them to share their rich experiences with each other and the researcher as well. Other reasons for interviewing the researcher several times included the following; first, it enabled the researcher to establish the consistencies of the responses of the participants across the interview sessions. It allowed the interviewees to talk at length and elaborate because they were given the opportunity to react to questions multiple times. It allowed the interviewees to talk at length and elaborate because they were given the opportunity to react to questions multiple times. The interviews were conducted at a time when children were on break. In all, each of the visits to the classrooms lasted for one hour. In the second phase, observation took place in all the two kindergarten classrooms. After the transcriptions of the interviews, the teachers were given opportunity

to cross-check whether the transcripts reflect their views (member checking) The observations provided an opportunity for the author to determine how teachers' level of knowledge about their practices unfolded in real-life classroom context. During observations, on occasion, and in an unobtrusive manner as possible, the author conversed with the kindergarten teachers while the children were engaged in certain small group activities or individual activities to seek clarifications from them reasons for engaging children in various kinds of activities. After the end of every lesson, the author engaged them in a discussion for about ten minutes to seek further clarifications on certain issues. This process of interacting with the teachers provided each one of them an opportunity to clarify an issue that was perplexing to the author while observing the teachers' instructional practices in the classrooms. That is during these sorts of activities, each of the teachers was seen moving from one group to another giving guidance to the children on how to accomplish a task whenever any of them encountered a challenge. This method provided an opportunity to observe and interact with the teachers two or three times during the study. Because the focus in this study is to explore teachers' perspectives about their practices in the classrooms, field notes rather than recording, reduced such intrusions. Such observations allowed enact issues beyond self-reporting because how teachers describe their actions and how their actions unfold in real-life teaching and learning context differ. The observations of the teachers were recorded after each of the teachers was interviewed. Apart from been a technique for generating primary data, observations serve as a check on the other data collection method. This method was used to check individual biases that are likely to be exhibited in the in-depth interviews. Also, the gathering of data using two research instruments allow for triangulation of data.

Procedure

The instruments were administered to the participants in the two case schools from May 2015 to November 2015. The data analyses were on case by case basis to identify key themes within each of the cases to answer the research questions. The teachers' thoughts were audio recorded and transcribed verbatim. The teachers' thoughts were further organised into categories. The themes that emerged from the analyses were further validated by the observational data. In short, the themes were determined through open and axial coding (Boeijie, 2010). From the analyses above, it can be concluded that a theme is a pattern across data sets that is important for the description of a phenomenon which is linked to a research question.

RESULTS

Case study analyses of the teachers at the Southern School (Tata)

Instructional strategies

Concerning the third research question, the analyses of the teachers' interviews transcripts and observations from field notes indicated that the two teachers used similar instructional strategies to promote children's development in their kindergarten classroom. Interestingly, these participants' views regarding instructional strategies for children's language development, as well as those for their holistic development pointed to two types of themes which were further validated by the observational data. The themes that emerged from these teachers'

comments included those referring to specific strategies aimed to teach specific subject areas which included picture-walk, think-pair-share and free play as well as generic ones which comprised play-based pedagogy and an integrated curriculum approach. Nonetheless, evidence from these teachers' responses is not enough for a conclusion to be drawn that either of them preferred play-based pedagogy or integration.

Subject area instruction and children's physical development

Both Kate and Sophia perceived the development of children's language and literacy skills in a kindergarten setting as a function of the effective use of instructional strategies. However, they differed in their perceptions of the most suitable instructional strategy for doing so. For instance, Kate valued the use of a think-pair-share instructional strategy because "It helps children who are seated close to each other to talk among themselves about the subject matter before "I come in to ask a question."

Interestingly, Kate drew on her personal experience as a student to explain why she valued think-pair-share as an instructional strategy for supporting her kindergarten children's language and literacy development. Kate elaborated:

Kate: When we were in school whenever our peers explain certain concepts to us, we understood it better than that of the teacher. Even though the teacher might have done well but because we are peers and the language is within our level we understood their explanations better. ... [With think-pair-share] any time a child raises his or her hand to answer a question, he or she is confident that the answer might be right because the answer has already been talked about with a friend.

For Kate, the think-pair share is an effective instructional strategy for children's language development because it provided an opportunity for children to share ideas with their peers in class, thereby boosting children's confidence in responding to questions posed by the teacher in class.

Sophia pointed to picture-walk as an effective instructional strategy for teaching concepts in language and literacy class because it helped her to promote the development of the children's listening and speaking skills. She explained:

Sophia: Picture-walk instructional strategy in language and literacy uses a conversational poster to develop children's language skills, such [as] listening and spoken aspects. The poster contains different kinds of pictures depicting issues that children are expected to discuss in class. If the topic is about birthday celebrations, the

pictures will help the teacher to initiate a conversation with the children by asking questions.

Sophia further elaborated on how a low-risk atmosphere, in conjunction with the clues the picture provides, increased participation, and in her opinion, contributed significantly to each child's socio-emotional well-being. For, example:

Sophia: ...If the topic is about birthday's celebrations, the child develops vocabulary about the celebrations. It also removes shyness from the children. It also makes the child have a feeling of being part of the class because when it comes to conversation, children's contribution in class should not be turned down. So, whatever the child says is accepted, and we go ahead to applaud him or her so that the children will feel free to say whatever he or she wants to say in class.

For, Sophia, children actively participate in class activities if the views they express on issues in class are respected and appreciated. In addition, Sophia perceived free-play as an instrument for promoting the physical development of children. She explained:

Sophia: As for me, every week, I set a period aside for the children to go to the school's playground and engage in any play that they like. This type of activity is important for children because it promotes their physical development.

The analyses of the observation, field notes further revealed that Sophia played some supportive roles while the children were playing on the playground. For instance, before the children started playing, she talked to them about the various choices that were open to each of them and guided them individually to make their preferred choices. She stood at the edges of the playground moving back and forth and keenly observing what the children were doing without interfering. However, the teacher did take part in the play whenever she wanted to demonstrate to the children how to master a skill. Whenever she saw any of the children idling about, she prompted him or her by calling the child's name and entreating him or her to get involved in the activity. The teacher also made sure that every child actively participated in a play activity that was of interest to them. She applauded the children who were doing well in their various activities. She also provided opportunities for children to interact among themselves by playing in groups or beside each other. She also made interventions to prevent the children from harming themselves and gave assistance to the children whenever they encountered any difficulty starting a play activity.

Holistic instruction

Kate and Sophia appear to have different views about suitable instructional strategies for the holistic development of children in kindergarten settings. While Kate preferred a play-based approach, Sophia, valued the integrated approach. For instance, Kate valued play-based instructional strategies because as she explained:

Kate: I think at the kindergarten level, children learn better when activities are in the form of play. For instance, anytime I am teaching, I give children the opportunity to play a game that is related to what we are learning in class. I know play is something that is of interest to children. So, in most of the activities [in which], I engage children, I introduce some element of play into it to arouse children's interests in what they are doing.

The data from the observation field notes further revealed that during language and literacy class when Kate was teaching the children four letters of the alphabet, the teacher engaged the children in a game. The purpose of the game was to use a creative, play-based way to help the children to identify the sound of the letter 'A' and the other letters of the alphabet (B, C, and D) in the midst of other letter sounds. The teacher then read a sentence that had the letter 'A' repeated three times in the sentence. The children were expected to listen attentively and identify the letter name that corresponds to the letter sound. A child who can match a letter sound correctly with a letter name scores a point. In the subsequent rounds of the game, the teacher repeated letter sounds of the other letters one after the other and the children were expected to match the sounds with the names. The children were put into groups of five to compete among themselves on the identification of the name of a letter name and its corresponding sound. Sophia, valued the integrated approach to teaching in a kindergarten classroom because it situated learning in a real-life context. She explained:

Sophia: I use the integrated curriculum approach a lot when I am teaching certain topics in class because it provides a favourable learning environment for young children to learn. I think children by their nature learn through lived experiences within the home setting. So, when they are transitioning from their homes to school, there is a need for me to give them similar learning experiences to help them learn better.

For the kindergarten child, the daily experiences of living and learning in the classroom are indivisible. Thus, in a kindergarten class, learning should be structured in such a way that it becomes part and parcel of the total experiences of children's lives. From my observations, for Sophia, to make it possible for children to understand their world during teaching in kindergarten settings, she usually incorporated different, but obviously, connected curriculum areas into a single unit. For example, in language and literacy class, a story could become the basis for Sophia to plan integrated learning activities for

the children. The characters and settings in the story (e.g. Ananse, the Confidence Trickster) provided a natural way for the teacher to introduce the children to various concepts in moral education, religious education, numeracy, environmental studies, natural science and creative art.

In sum, from the data sets, it appears that the teachers from Tata School used a variety of instructional strategies to promote children's development in their kindergarten setting. However, the developmental needs of children informed the kind of instructional strategy that the teachers used in class. Specifically, evidence from the research suggests that the study's participants used think-pair-share and picture-walk instructional strategy to develop language skills of children while play-based and integration were used to promote children's holistic development. Moreover, through free play, the teachers provided an opportunity for children to develop physically.

Case study analyses of teachers at Northern School (Kariba)

The second case study was conducted at Kariba School, which was sited in a rural setting. As in the previous case, the analyses of both teachers, Ramatu and Akotia, interview responses alongside observational data captured, produced several themes which address each of the four research questions.

Instructional strategies

Concerning the third research question, the analyses of the teachers' interviews transcripts and the observations field notes indicated that the two teachers used similar instructional strategies to promote children's development in their kindergarten classroom. These included picture-walk; play-based approaches; and integrated curriculum approach, with the former strategy specific to content development.

Subject area instruction

While Ramatu and Akotia saw the development of children's language and literacy skills as a function of the effective use of a picture-walk instructional strategy, nonetheless, they differed in how they perceived its impact.

Ramatu: When I am teaching a topic such as the 'family' in language and literacy class I use picture-walk and role-play. First, I paste a conversational poster which has pictures depicting activities that go on in a family setting. As I flip through the picture, the children take turns to describes incidents in the pictures and predict what is likely to happen in the next picture. After this activity, I

call the children one after the other to play some roles their mother or siblings engage in at home. These activities help children to talk in class.

Akotia: I use picture-walk in language and literacy class to promote children's moral development. If the lesson is storytelling and it is about how tortoise beat the overconfident hare in a competitive race, I take the children through a conversational poster that has pictures depicting the various stages of the race. As I flip through the poster, I ask the children to comment on the various episodes of the story and the moral lesson that they can draw from it. By the time, I finish going through the pictures with them; they will be able to narrate the whole story.

For Ramatu, then, picture-walk provided an opportunity for children's oral language development, while Akotia saw picture-walk as a means of developing children's moral values through storytelling.
That said, both teachers, Ramatu and Akotia identified additional ways picture-walk impacted children's learning.

Ramatu: It helps children develop their oral skills, observational skills, and coordination skills because the children have to observe incidents depicted in the pictures before they can talk about them with their peers in class.
Akotia: I think it helps children develop the ability to imagine things, follow the sequence of events and predict their likely outcomes.

Thus, Ramatu spoke on skills development, while Akotia pointed to cognitive development as key outcomes of an instructional strategy such as picture-walk. Interestingly, Ramatu further explained what she meant as a coordination skill and its relevance for the children, within the social context of Kariba School. She explained:

Ramatu: When I talk about coordination skills, it is the movement of the eyes from left to right during reading. In this school, some of the children attend Arabic classes after school. In Arabic classes, children write from right to left. So, such children are often confused as for how to write in formal classroom settings. So, I use the inscription on the conversational poster, and with the aid of flip board, I help them understand how to read from left to right.

Thus, for Ramatu, because some of the children in her class have to adjusted to two diverse ways of writing (Arabic and English), she is cognizant of how using picture-walk can help the children overcome this challenge if the differences are made explicit.

Holistic instruction

Both Ramatu and Akotia valued instructional strategies which promoted the holistic development of children in

kindergarten settings. For, instance, Ramatu valued a play-based approach to learning in a kindergarten classroom because it promoted the social, emotional and cognitive development of children. She explained:

Ramatu: I use play-based approach to teaching a lot in this class because I have a strong feeling that the child's world is centred on the play. So, I rely on play-based activities to give children the opportunity to interact with their peers, express their emotions and develop their imaginative abilities.

Akotia, however, valued the integrated approach to teaching because it promoted the social-emotional and cognitive development of children. She explained:

Akotia: I often use the integrated approach a lot in this class. In this country, the goal of the kindergarten curriculum is to help the child become a well-balanced individual. So, in this class, I provide an opportunity for the children to interact with others, express their emotions, develop moral values, and develop their imaginative abilities and their motor skills.

The observation field notes further revealed that Akotia used an integrated approach during a language and literacy class which focused on a story entitled "The Lion and the Mouse" In this lesson, Akotia took the children through a conversational poster, which depicted the plot of the story in a pictorial form. The pictures highlighted episodes of the ungrateful nature of the lion. The children were expected to predict the consequences of the lion's actions and inactions. In addition, however, the teacher (Akotia) used the setting of the story to introduce concepts such as the number of animals in the story, the types of plants in the environment, the creator of the animals, and the number of plants they saw in the environment. Finally, the children were asked to draw one of the animals depicted in the story. Thus, the plot of the story, the setting of the story and characters in the story served as the basis for Akotia to use a literature-based integration, to introduce children to new concepts that cut across different subject areas.

Overall, from the data sets, it appears the teachers from Kariba School used a variety of instructional strategies to promote children's development in their kindergarten setting. However, the developmental needs of children informed the kind of strategy each teacher used in class. Specifically, evidence from the study suggests that the study participants used picture-walk instructional strategy to develop language skills and moral values of children while play-based pedagogy and integration were used to promote the holistic development of children.

Across case analyses: Teachers' practices at Tata and Kariba Schools

To further understand the ways in which kindergarten teachers perceived instructional strategies, across-case analyses (by school) is reported next. As expected, some of the themes reported within each case were unique to that case. However, most themes were shared by all four teachers in the study, regardless of the school setting in which they taught. Thus, to consider the analyses of the four teachers' (Kate and Sophia at Tata School; Ramatu and Akotia at Kariba School) perspectives with respect to instructional strategies, the themes derived from within-case analysis were collated and served as the basis for the cross-case-school analyses.

Instructional strategies

For further insights into the kinds of instructional strategies the teachers used in their kindergarten classrooms, a cross-case analysis was reported. As envisaged, some of the themes reported within each case were peculiar to that case. Nonetheless, most of the themes were common to all four teachers in the study despite the school setting in which they taught.

The participants across cases valued play-based and the integrated curriculum approach as effective instructional strategies for the promotion of children's development in kindergarten classroom settings. As well, the picture-walk instructional strategy was common to all four of the teachers. However, they perceived its impact on children's development differently because, while Sophia at Tata School and Ramatu at Kariba School linked language learning to picture-walk, Akotia at Kariba School saw its value more generally regarding developing children's imagination. But across cases, a pair of teachers valued the play-based approach (Kate and Ramatu), and two valued the integrated approach (Sophia and Akotia). Thus, it appears that the choice of instructional strategy is based less on context and more on individual teacher's choice. Interestingly, looking at the cases then, it can be seen that children in each classroom were exposed to both play-based and integrated approaches, by virtue of having pairs of teachers.

DISCUSSION

In the current study, these four teachers believed using diverse forms of instructional strategies promoted children's development. While there were differences and similarities regarding their individual choices, a common thread running through the strategies the participants reported (play-based and integrated pedagogy; picture walk and think-pair-share) was a focus on children's needs. That is, as detailed in the findings chapter, the teachers at Tata School and those at Kariba School indicated that they used these various instructional strategies in order to address the different developmental needs of their children. Indeed, the strategies, namely

play-based and integrative pedagogies, think-pair-share, and free play, to which these teachers pointed, are commonly found throughout the early childhood literature and closely aligned with developmentally appropriate practices (Bredekamp and Copple, 2009). Likewise, these findings, at the very least, indicate that teachers, in both settings (rural and urban), were equally conversant with both generic (e.g. play-based, integrated) and specific (e.g. picture walk) developmentally appropriate practices promoted in Ghana's mandated curriculum.

Interesting, only two of the four teachers, namely Sophia, from Tata School and Akotia, from Kariba School, spoke of integration as an effective teaching and learning approach for kindergarten classrooms. As observed, each of them relied heavily on learning centres to integrate their children's experiences into the classroom and promote their children's holistic development. Although, the data collected was not conclusive, it appeared that these teachers' previous successful experiences with integration through learning centres influenced their instructional strategy choice. Of particular note was the similarity between their approach and that of Hauser et al. (2010) activation principle, which situates learning within the context of what the child already knows in order to facilitate the child's understanding of related concepts. Indeed, Sophia captured the integration of everyday experiences with those at school when she stated:

"I think children by their nature learn through lived experiences within the home setting. So, when they are transiting from their homes to school, there is a need for me to give them similar learning experiences to help them learn better."

This then suggests that these teachers believed such integrated learning activities positively impact children's learning, as was the case for young children in the study of McMullen et al. (2005). What remains unclear from the data, however, is whether this approach to integration, which Sophia and Akotia focused on in their separate interviews, was one of many approaches to integrating children's learning experiences, a dominant/preferred approach or these kindergarten teachers' only approach to integration. There were insufficient probes within the semi-structured interviews to fully determine the extent of their knowledge and understanding of how to interpret and apply other means of integration, and thus, the reader is cautioned not to assume it was a one-size-fits-all philosophy, without further research.

In contrast, all four participants spoke of play-based pedagogy as central to developmentally appropriate ways of promoting children's' development in diverse ways. More specifically, they indicated that to do so, activities which specifically address the learning needs of individual children are designed to enhance, promote and improve certain areas of children's development. Indeed,

observational data documented various learning activities which these teachers engaged the children, in both settings, in diverse play-based experiences. For example, Kate and Sophia at Tata designed an activity, they labelled "wizard counter", to promote their children's socio-emotional development, while Ramatu and Akotia's (search and find) aimed to develop children's socio-physical aspects of their lives. Of note is that for the most part, these teachers used context-specific and relevant play-based activities to address certain perceived needs of their children. As such, these kindergarten teachers appear to interpret developmentally appropriate play-based pedagogy as teaching that is both informed by and supports children's individual needs. It would seem then that all four teachers concur with Bredekamp (2014) who argued that children's holistic development (socio-emotional, intellectual and moral) can be effectively supported through play-based pedagogy because of the various forms of activities it encompasses. In addition, these teachers, as Ramatu reported, seemed to value the resonance such an approach has with children's inherent capacity to learn from and through play:

Ramatu: "I use play-based approach to teach a lot in this class because I have a strong feeling that the child's world is centred on the play. So, I rely on play-based activities give children the opportunity to interact with their peers, express their emotions and develop their imaginative abilities."

However, it is not surprising that these teachers point to the effective use of play-based pedagogy because their teacher education backgrounds and experiences would have included knowledge regarding such developmentally appropriate means of promoting children's holistic development. That said, the author argued that their nuanced understanding speaks of the participants' ability to make connections between such theoretical knowledge and practice, readily pointing to personal ways in which they apply instructional strategies within their classrooms. It is also noteworthy that this study of Ghanaian teacher's perceptions regarding instructional strategy usage in kindergarten classrooms corroborates the beliefs and practices of Japanese participants (six nurseries and four kindergarten teachers) gathered through interviews in Hedge et al. (2014) study.

The underlying thread of, taking into consideration differences in the children's developmental needs when designing learning activities also arose, when the participants in this study elaborated on developmentally appropriate features of "supporting" instructional strategies (e.g. picture-walk and think-pair-share). A central component of these strategies was the use of visuals (e.g. conversational posters) as developmentally appropriate tools for making learning meaningful and relevant to young children in these kindergarten settings.

Since the visual resources, themselves were supplied by the Ministry, and strategies such as picture-walk were mandated in the curriculum, it was difficult to ascertain if these teachers' compliance with the curriculum indicated that they too saw the relevance and value of such interventions. That said, since these teachers perceived such supporting strategies (e.g. think-pair-share and picture-walk) as practices that they might personalise in order to promote and improve their particular children's development, suggesting that these teachers recognised the valuable role surrounding pictures/imagery with productive conversations could have in developmentally appropriate practice.

Interestingly, a substantial body of research literature (Palermo, 1970; Pressley, 1977; Migliorini and Rania, 2017) points to a viable role picture-imagery plays in children's language development. For instance, based on observation of kindergarten children in Italy, Migloorini and Rania (2017) argued that picture imagery aids children's language development because it serves as the basis for initiating a discussion with children which in turn, develops their oral language skills. Of note then is that the current study's observations (and interviews) provide similar evidence from a Ghanaian context, whereby children and teachers (both rural and urban) readily engage in talk about the conversation posters, with children drawing on their previous experiences to form their reflections on and response to the topics. As indicated throughout this discussion, because the centralized kindergarten curriculum in Ghana and these teachers' university education and professional development is heavily infused with DAP (e.g. these teachers are expected to use picture imagery to teach language and literacy), it is challenging to discern when and if the teachers' simply expressed views defer for these authorities. That said, the ease with which these teachers illustrated how developmentally appropriate, such strategies were and how they used the instructional strategies in context-specific ways, suggests that the needs of the child being addressed were somewhat "localized", and not entirely dictated by universal, and/or Westernized definitions associated with DAP.

Conclusion

Moreover, the teachers are expected to take into account the needs of individual children when planning the kindergarten curriculum. For example, it was evident from the study that children cannot separate their everyday lived experiences in their immediate environments from what they learn in their kindergarten classrooms. Thus, it appears that for instructional strategies to have the desired impact on children's development, the lived experiences of children should be the driving force. Moreover, the study has shown how we understand the nature of children, how they learn and the corresponding teachers' instructional practices that promote effective

teaching and learning in kindergarten classrooms. Future research should explore specific instructional strategies for developing specific multiple intelligences of young children such as socio-emotional or socio-spiritual. However, the study was limited to how instructional strategies are used in early childhood settings to enhance and promote children's development.

Implications for Teacher Preparation and Professional development

The study demonstrated the potentials that exist for the use of instructional strategies to complement the teachers' attempt to create constructive learning environments in early childhood settings. Particularly, the study established that insights of preservice early childhood teachers into appropriate use of both specific and generic instructional strategies regarding when and how to use each of them within the teaching and learning context has the potential to unearth children's potential by situated the selection of instructional strategies within the context of the uniqueness that individual children bring to the teaching and learning context with respect to interests, needs and potential. This understanding is significant in that more reflective practice can proceed thereafter, to select a particular generic instructional strategy to deal with holistic developmental needs of children. Importantly, the study also identified the strength of specific instructional strategies as alternative strategy that may help to point out the nuances regarding a worthwhile means of obtaining observational evidence to inform the use of appropriate specific instructional strategy to deal with certain developmental needs of individual children that cannot be addressed through a generic instructional strategy.

CONFLICT OF INTERESTS

The author declares that there is no conflict of interests.

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Full Length Research Paper

Views of pre-service teachers following teaching experience on use of dynamic geometry software[i]

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The study aims to determine the views of final-year pre-service mathematics teachers towards their experience of the use of dynamic geometry software in teaching, following the implementation processes that they carried out when using this software in a real classroom environment. The study was designed as a case study, which is one of the qualitative research methods. The study was conducted with four pre-service teachers studying in the mathematics teaching department at the education faculty of a university in Turkey during the 2016 to 2017 academic year. As one of the results of the study, it was observed that the pre-service teachers, following the theoretical lessons that they had in the education faculty prior to implementation, gave more limited opinions, whereas during the school experience application of dynamic geometry software, following its application in a classroom environment, they mentioned more features of this software for use in teaching. The pre-service teachers, in relation to their real classroom experiences, expressed their views on the features "concretisation and visualisation", "possibility of presenting many examples", "making students feel that mathematics is valuable", "permanence and facilitation of learning", and "preventing erroneous mental representations" with regard to the role of dynamic geometry software (DGS) use in teaching and learning. Yet, prior to using DGS in the classroom, these pre-service teachers had given importance only to the "concretisation and visualisation" and "permanence and facilitation of learning" characteristics.

Key words: Dynamic geometry, pre-service mathematics teacher, geometric shapes, views.

INTRODUCTION

Teachers' beliefs and views about teaching have a strong influence on their decisions and behaviours (Ernest, 1989; Fang, 1996; Tillema, 2000; Thompson, 1992). Thus, research on teachers' views show that when their views about teaching change their practices in the classroom change also in parallel (Givvin et al., 2001). One of the fields of mathematics where teachers have different views and different beliefs about teaching is the

field of geometry. Indeed, these differences of views in the teaching of geometry came from the fact that the teaching of the geometry has to treat the concrete and the abstract objects to teach abstract objects (Steinbring, 1988; Laborde, 1994; Houdement and Kuzniak, 2006; Schneider, 2012; Rigaut, 2013).

It is argued that geometry, since it both contributes to mathematics learning and deals with concrete shapes and objects, should begin to be taught from an early age and that rather than being learnt as a separate subject, it will be more useful for it to be incorporated with the other mathematics subjects (Olkun and Toluk, 2003). For this reason, in order to increase the success of students in these fields, mathematics and geometry teaching should be perceived as an indissociable, mutually complementary whole. It may be said that especially during the primary school years, geometry teaching is considerably important (Onal and Demir, 2012). In student learning during the primary school years, the transfer from the concrete to the abstract operational stage is very important. Educational researches stress the importance of concretisation as one of the basic factors in content of lessons prepared for primary school pupils (Aydogdu et al., 2016). Nowadays, technological resources play a part and are in active use in the classroom environment for the concretisation of geometric objects.

Recently, technology is developing at a great speed, therefore changes are also occurring in student learning (Ozdemir, 2012). Nowadays, when students are so responsive towards this technology, it is considered necessary to integrate technology into lessons. It may be said that since technological tools play an effective role in the concretisation of abstract mathematical terms, when teaching of primary school pupils is carried out by making use of suitable technologies; these can ensure that students have a better perception of mathematics and thus make a positive contribution to their learning of mathematics.

National Council of Teachers of Mathematics (NCTM) (2000) also highlights the fact that teachers can improve students' learning by integrating technology; as well as richer learning environments can be set up. The research results show that the environments offered by dynamic geometry software (DGS) have a positive effect on learning, especially concerning the learning of geometric objects (Clements and Battista, 1992). As a reflector of computer technology onto geometry lessons, DGS too, is a beacon of hope for these aims to be realised in mathematics teaching (Guven and Karatas, 2003). Many studies exist in the literature with regard to the use of DGS in geometry teaching at all levels (Akgul, 2014; Topaloglu, 2011; Yavuzsoy-Kose and Ozdas, 2009; Acikgul, 2012; Guven and Karatas, 2009; Dimakos and Zaranis, 2010; Laborde, 2001; Furinghetti and Paola, 2002; Jones, 2000).

Geometer's Sketchpad, Cabri Geometry, Cabri 3D,

Geogebra, Logo and 3DMath are regarded as the best-known dynamic geometry programs (Hohenwarter and Jones, 2007). Cabri Geometry, which is regarded as the first and most developed example of dynamic geometry programs, is a micro-world that allows the attempting of different ways to solve a problem, the discovery of a concept and its relationships, and at the same time, the concretisation of many mathematical concepts that cannot be seen in other media (Clarou et al., 2001). The original language of the program is French, and it has been translated into several languages such as English, Italian, Turkish and Japanese. With the Cabri geometry program, all geometric shapes can be drawn and animated. As the shapes can be held and animated, it may be said that the program keeps the students' interest alive, since it provides the opportunity to seek different solution methods and to reach generalisations by controlling the solution methods (Broutin, 2015).

Cabri 3D, another of the dynamic geometry programs, is a new-generation DGS suitable for use with smart boards. Cabri 3D, by which shapes such as points, lines, planes, polyhedrons, spheres, cones, cylinders and prisms can easily be made, fully opens the doors of 3D space for students to explore. Thanks to Cabri 3D, students have the opportunity to see relationships between geometric shapes and their positions in relation to each other, and also to examine the other faces of geometric shapes by turning around the shapes that they have formed whenever they desire. Cabri 3D is a micro-world that allows students to discover and form geometric shapes and which, by making use of these shapes, facilitates their understanding of mathematical concepts. Moreover, the program allows them to form hypotheses on the geometric shapes made and to test the hypotheses formed (Pandiscio, 2002).

The Cabri 3D program has features not found in other programs. It enables the concretisation of many mathematical concepts that cannot be seen in other media (Clarou et al., 2001). Indeed, in the Cabri3D environment it is possible to build geometric objects (cylinder, prism, cube, pyramid, etc.) in a few clicks, to rotate them, to show their openings dynamically, and to view them from different locations. The software appears as a solution to problems encountered during the process of conceptualization and mental modelling by students of 3D objects (Hugot, 2005).

When considering that the three basic components of the education process are teaching programmes, students and teachers, it may be said that however healthy the relationship is between these three components, so will education be effective and of good quality (Arslan and Ozpinar, 2008). Therefore, since well-trained teachers are considered necessary to carry out mathematics teaching in an effective way, in recent years the matter of teachers' pre-service learning experiences has been dwelt upon (Açikgül, 2012). When pre-service teachers begin their working lives, they must accept that

they will encounter a student group that is well-informed about technology and that in order to achieve the desired aims of their duties, technology plays a role in education; moreover, they must possess the skills to use technology correctly (Bakirci et al., 2009). For teachers to develop these skills, the faculties of education must also train them on these. The modules that teachers follow during their training have a strong influence on their teaching. There are several researches that indicates the need for training modules on the use of ICT in teaching during the formation of pre-service teachers (Baldin, 2002; Clarke, 2009; Habre and Grundmeier, 2007; Kokol- Voljc, 2007).

The general opinion in pre-service teacher training is that the teacher training period should be increased and that, together with this, it should be realised that the teaching practice carried out in schools must be given as much importance as the theoretical classes in the faculties. It is seen that besides the theoretical courses in teacher training programmes, the presence of lessons in which students can put into practice what they have learnt are important in terms of their development (Beeth and Adadan, 2006; Peker, 2009; Tigchelaar and Korthagen, 2004; Eraslan, 2009; Kahyaoglu and Yangin, 2007; Kablan, 2012). When considering one of the fundamental problems in teacher training, it is observed that field knowledge, that is the theoretical knowledge of the teaching profession obtained in the training, is not sufficiently maintained along with practical studies (Balci, 2007).

Besides, many studies made on pre-service teachers point out that they cannot make sufficient use of technology in their lessons (Güven and Karatas, 2004; Arslan and Ozpinar, 2008; Erdemir et al., 2009). Therefore, it is seen that pre-service teachers, as part of their teaching practice classes, experience some problems while giving lessons in their practicum schools, and that these problems are exacerbated by the integration of technology into the lessons. In this context, it is considered that the views of pre-service teachers with regard to the lessons they carry out in which DGS is employed will be a determining factor in their use of this technology in their professional lives as teachers.

Aim of the study

The aim of this study is to determine the views of primary school mathematics pre-service teachers with regard to the use of DGS in teaching, following the practice they carried out in a real classroom environment when DGS was used. In this context, the problem sentence of the study is as follows:

What are the views of final-year students in a primary school mathematics teaching department with regard to the use of DGS in teaching following implementation of their prepared lesson plans for the subject of learning 5th grade geometric shapes?

METHODOLOGY

Research model

This basis of this research is founded on qualitative research designs, and was designed as a case study. A case study is "a well-established research strategy where the focus is on a case (which is interpreted very widely to include the study of an individual person, a group, a setting, an organization, etc.) in its own right, and taking its context into account" (Robson, 2002). The research was designed as a type of case study known as "a case study consisting of several individuals". In this type of case study, the characteristics of several individuals are studied and perceptions and attitudes are focused on which serve as the cause of a known result. Any possible experiences, determinants, factors, causes, processes, etc., which might affect the result are researched (Robson, 2002).

Study group

This was made up of final (4th) year students studying in the Primary School Mathematics Teaching department at the Education Faculty of a university in the north-east of Turkey during the 2016-2017 academic year. Four pre-service teachers (three female, one male) took part in the study. As the aim of the study was to understand the viewpoints of final year students of Primary School Mathematics Teaching towards DGS following the implementation of the prepared lesson plans given to them, it was considered that the purposive sampling method would serve the study. The purposive sampling method, consists in choosing cases rich in information concerning the purpose of the research in order to make in-depth analyses. There are six types of purposive sampling of which one type is the maximum variation sampling method. Maximum variation sampling method is obtained through the choice of different cases related to the problem of research (Buyukozturk, 2012).

For the selection of the pre-service teachers participating in the study, a questionnaire was conducted on the pre-service teachers, on a voluntary basis, aimed at determining their frequency of computer use, their self-efficacy with regard to computer use, which dynamic geometry programs they were familiar with and their opinions of the teaching profession. Each student answered six open-ended questions, four questions prepared in categories, and the "Attitude Scale with Respect to Conducting Computer-Assisted Learning", consisting of twenty Likert-type questions, developed by Arslan (2006). The internal validity and reliability of the scale was analysed and a Cronbach's Alpha reliability coefficient of 0.93 was determined. The scale and open-ended questions were applied to all final (4th) year students (thirty-eight pre-service teachers), but since seven pre-service teachers did not volunteer for the study, the data of these seven pre-service teachers were disregarded.

The questionnaires of thirty-one pre-service teachers volunteer for the study was numbered from one to thirty-one. For the preselection of the pre-service teachers who were to participate in the study, the answers of thirty-one pre-service teachers to the questions in the Likert-type scale were analysed with the statisitical package for social sciences (SPSS) software package and the open-ended questions were analysed through content analysis. In order to ensure heterogeneity in the selection of the pre-service teachers, three categories were determined by the researchers, namely computer use, dynamic geometry software and view of the teaching profession, by utilising the data obtained.

Based on the analyses of the responses to the questions on the use of the computer, the codes "good" and "low" were determined for the category "frequency of computer use". Using the answers to questions about dynamic geometry software, teachers' skills to use the DGS are coded as "beginner" and "experienced". "Positive" and

Table 1. Characteristics of participating pre-service teachers.

Number	Age	Gender	Type of school graduated from	computer use	Dynamic geometry programs	Teaching profession	GPA
A5=Hatice	21	Female	Anatolian high school	High	Experienced	Positive	3.10
A17=Berke	21	Male	Teacher training school	Low	Experienced	Negative	2.55
A18=Elif	21	Female	Anatolian high school	Low	Inexperienced	Positive	2.70
A31=Miray	21	Female	Teacher training school	High	Inexperienced	Positive	2.57

"negative" codes were identified in the teachers' perspectives on the profession categories by analysing responses to open-ended questions about their views on the teaching profession. The responses of each of the thirty-one teachers were tabulated and eight different combinations were identified to ensure diversity. Thus, thirteen teachers were selected.

As a result of the preselection conducted, and also by utilising other studies related with the subject, interviews were conducted with thirteen pre-service teachers with a semi-structured interview form. Transcripts of the data obtained from the interview forms were made and analysed by the researchers. Some pre-service teachers were eliminated since they were not keen to have their lessons listened to and analysed in detail, the pre-service teachers most willing to take part in the study were selected. Four pre-service teachers who participated in the study used the nicknames that they chose as shown in Table 1, instead of their real name because of confidentiality. The four pre-service teachers selected for the study, the criteria affecting the selection of the pre-service teachers, and other characteristics of the pre-service teachers are presented in Table 1.

Data collection and analysis

Prior to the implementation process with the pre-service teachers, interviews were carried out with a semi-structured interview form related with use of DGS. The semi-structured interview form consisted of two parts: a part where it is about questions with short answers and a part where it is about open questions on the lived experiences in the school.

Information was given to future teachers about the aim of the research during the interviews. Each of the four selected pre-service teachers was interviewed separately and the interviews were recorded so that no data could be lost. At the beginning of the interview, permission to record the voice was requested for each teacher and the length of the recordings ranged from 21 to 79 minutes. The interviews were transcribed word-by-word by the researchers.

To prevent any possible loss of data during the implementation process, lessons were video-recorded and after the pre-service teachers had applied their lesson plans. A preliminary interview was conducted with four selected pre-service teachers to explain the lesson plans and gather teachers' opinions on the plans. After the implementation of each of the plans, short interviews were conducted to analyse teachers' experiences with their teaching. Following the implementation process, interviews were conducted with a semi-structured post-lesson interview form, containing ten open-ended questions. The researcher interviewed the teachers with the interview form after each courses. Each interview was recorded with the permission of the pre-service teacher. The content of the questions was as follows:

Experiences of the lessons in which implementation was made, views on lesson plans, viewpoint of pre-service teachers towards the teaching profession following implementation, and viewpoint of pre-service teachers towards the utilisation of DGS in their teaching careers.

Some of the open-ended questions asked on the post-implementation semi-structured interview form were also questions asked to the pre-service teachers prior to implementation. The pre-service teachers' responses were analysed using the content analysis method. Content analysis, consists of a summary of the basic contents of the data and the messages they contain (Cohen et al., 2007). In the research, the coding was done according to the concepts obtained from the data, and the codes were developed by the researchers. Using the obtained codes, categories were obtained.

Implementation

The researchers went to meet the mathematics teachers, principals and vice-principals in the schools to explain the implementation process and to obtain permission. After all procedures had been completed, the school where implementation was to be carried out was designated. The pre-service teachers who were to carry out the implementation began working in four different classes of the 5th grade at a state school in the Nilüfer district of Bursa.

The pre-service teachers chose their own classes and were each given their own classroom. All pre-service teachers carried out all their lesson plans in the classes that they had chosen for themselves. According to the information given by the school management and the subject teachers, the levels of the students in the classes were evenly distributed in a heterogeneous way. It was considered that the pre-service teachers, having carried out their practicums over a four-month period at the same school as the implementation, would be familiar with the classes they had chosen. The pre-service teachers taught the learning outcomes in the subfield of geometric shapes to the 5th grade students, utilising the Cabri 2 and Cabri 3D software, and concrete material prepared by the researcher.

The four pre-service teachers carrying out the implementation used the three-day lesson plan and twelve study sheets prepared by the researcher. During the preparation of the lesson plans and study sheets, relevant to the subject of the study, the learning outcomes in the study field of geometric shapes to be taught during the study were taken by utilising the 5th grade mathematics teaching programme of the Education Ministry. In accordance with the learning outcomes, the lesson plans and study sheets were prepared by the researchers by scanning 5th grade course books, the mathematics lesson teaching programme, source books, books prepared for mathematics teaching, researches carried out in previous years, and the relevant literature. The prepared lesson plans and study sheets were examined separately by five teachers with at least five years' experience, and these teachers expressed their ideas to the researchers. Two of the teachers whose views were sought are also doing postgraduate programmes. After arranging the lesson plans and study sheets with the help of these expert opinions, the researchers gave the final shape to the lesson

plans and study sheets after also consulting the ideas of a lecturer. Video recordings were made of each pre-service teacher while they were giving their lessons. After the lessons were given, these video recordings were examined by the researchers, then the post-lesson interview forms were prepared separately with each pre-service teacher and the semi-structured interviews were made by using the forms. Each interview was recorded after permission had been obtained from the pre-service teachers. The interviews were analysed through content analysis by making transcripts of each post-lesson interview.

Validity and reliability

Some of the points to consider with regard to validity in case studies are listed thus: In order to ensure validity, the following may be utilised: variety of data, extensive time spent in the field, taking the views of an individual or several individuals involved in the research with regard to the prepared report, and consulting an external supervisor with a view to examining the project (Creswell, 2007; Cepni, 2012). Importance has been given to the matter of validity in this study, too, and this is explained in detail below. It is important to share the reports obtained by the researcher with individuals involved in the research and to receive their opinions (Cepni, 2012). In this study, too, the participants were informed in detail about the aim of the researcher, how the data would be used, and how they would be solved, and during the implementation they were included in the academic part of the research. The findings were interpreted both by the researcher doing the research and by a lecturer, and agreement was reached on these interpretations. Reliability of a study is attained when the study is repeated in the same way by another researcher, and the same or similar results are obtained. In order to increase reliability in case studies, researchers should define the processes of the study clearly, should support them with relevant documents, and should in turn develop and explain their research in a systematic way. In this study, too, the researcher took care to explain the details of the process of the same research which she wished to conduct with different teachers or pre-service teachers, and explained in detail the categories revealed as a result of the content analysis made for the solution of the data (Creswell, 2007). Precautions against data loss were taken by the researcher through interviews made on the basis of recordings and transcripts, and behavioural gestures made during the interviews were noted and stated in the transcripts. In the study, in order to reduce the anxiety of the pre-service teachers to a minimum, they were assured at the start that in the publications to be made, names other than their own would be used. Furthermore, it was determined that the study made would in no way affect their academic grades.

RESULTS AND DISCUSSION

The data obtained from the post-implementation semi-structured interviews with the pre-service teachers were analysed, and the views of the pre-service teachers following implementation with regard to use of DGS were revealed; also, comparisons were made with some pre-implementation views with regard to use of DGS.

Following the views of the pre-service teachers with regard to use of DGS that were examined in three categories as a result of the content analysis made prior to implementation, these views were also examined in three categories after implementation, and the categories were determined as "the role of DGS use in teaching and learning", "positive aspects of operations with the use of DGS", and "negative aspects of operations with the use of DGS". In this section, the results will be given separately for each category determined by content analysis.

The codes revealed for the category named "the role of DGS use in teaching and learning", and the distribution of the pre-service teachers in relation to the codes are given in Table 2. As can be seen in Table 2, with regard to the codes revealed in the research, at the end of the implementation period, by utilising the opinions of the pre-service teachers, the codes for the "role of DGS use in teaching and learning" category were organised as "concretisation and visualisation", "possibility of presenting many examples", "making students feel that mathematics is valuable", "permanence and facilitation of learning", and "preventing erroneous mental representations".

As distinct from the pre-implementation views, in line with the views of the pre-service teachers, the codes "possibility of presenting many examples", "making students feel that mathematics is valuable", and "preventing erroneous mental representations" were added to the "role of DGS use in teaching and learning" category. The pre-implementation code, "facilitation of learning", was expanded upon in the light of the opinions of the pre-service teachers and presented as the code "permanence and facilitation of learning". The "learning through doing and experiencing" code, which was used prior to implementation, was removed. However, it was found that in the comments of the pre-service teacher named Hatice who commented on that code, there were comments in parallel with her comments made prior to implementation.

The pre-service teacher named Hatice, while stating views on the "learning through doing and experiencing" and "facilitation of learning" codes for the "role of DGS use in teaching and learning" category prior to implementation, stated views on the "concretisation and visualisation", "possibility of presenting many examples", and "making students feel that mathematics is valuable" codes for this category after implementation.

The pre-service teacher named Berke stated his views on only the "enabling effective learning through concretisation and visualisation" code for the "Role of DGS use in teaching and learning" category in the lessons prior to implementation. However, it is remarkable that after implementation, by expressing views on the "concretisation and visualisation", "possibility of presenting many examples", "making students feel that mathematics is valuable", "permanence and facilitation of learning", and "preventing erroneous mental representations" codes for this category, he expressed views for all codes.

The pre-service teacher named Elif, while stating views on the "enabling effective learning through concretisation and visualisation" code for the "role of DGS use in

Table 2. The role of DGS use in teaching and learning.

Category	Code	Relevant pre-service teachers prior to implementation	Relevant pre-service teachers following implementation
The role of DGS use in teaching and learning	Concretisation and visualisation	Berke, Elif	Hatice, Miray, Berke
	Possibility of presenting many examples	-	Hatice, Berke, Elif
	Making students feel that mathematics is valuable	-	Hatice, Berke
	Permanence and facilitation of learning	Hatice, Miray	Miray, Berke, Elif
	Preventing erroneous mental representations	-	Berke

teaching and learning" category in the lessons prior to implementation, expressed views on the "possibility of presenting many examples" and "permanence and facilitation of learning" codes for this category following implementation. The pre-service teacher named Miray stated opinions on the "facilitation of learning" code for the "role of DGS use in teaching and learning" category in the lessons prior to implementation, whereas she presented views on the "concretisation and visualisation" and "permanence and facilitation of learning" codes for this category after implementation.

The analysis of the post-implementation views of the pre-service teachers for the "role of DGS use in teaching and learning" category is presented below. While the pre-service teachers named Berke and Elif stated views on the "concretisation and visualisation" code before implementation, it was seen that the pre-service teachers named Berke, Miray and Hatice expressed opinions on this following implementation. The views of the pre-service teachers on the code named "concretisation and visualisation" are given below:

Hatice: *"Children love coloured things and when the surface developments on the board were reformed, they said things like 'Ah, it's really happened', and 'so it means this can really be done with surface developments'."*
Berke: *"When students are at the stage of concrete thought, it's already difficult to explain something abstract to them in words. You have to make use of concrete materials, and we have already made use of them, but in the end, there is a smart board here and we have also utilised that. [...] In terms of concretisation, we can say that in the lives of the children this really exists directly. When they see something concrete in front of them they comment accordingly."*
Miray: *"When teaching the students, it is much more difficult to teach them when an abstract subject appears, and we have concretised this. Especially when reforming the prisms and forming the geometric shapes by using Cabri, their imagination is stretched, they also see things on the screen and these become more concrete."*

It can be said that according to pre-service teachers, it is very effective to use materials in the teaching of abstract concepts, since students are considered to be in the period of concrete conceptualization. When the pre-service teachers' views before and after the implementation are compared, it can be seen that they expressed their opinions more clearly by giving examples based on their experiences after the application, whereas before the application they had given shorter and more predictive opinions.

For the "possibility of presenting many examples" code, whilst no pre-service teachers expressed views on this prior to the implementation period, it was seen that the pre-service teachers named Hatice, Berke and Elif stated opinions on this following implementation. The pre-service teachers expressed their views that the wide variety of the rectangular prism surface developments prepared through the Cabri Geometry program was beneficial to the students, with the following statements:

Berke: *"The children have seen the shapes visually, and by varying the shapes with different examples, they are reinforced in the children's minds."*
Elif: *"We have quickly shown more than one shape at the same time, and they have benefited from seeing different things"*
Hatice: *"We were only able to make two or three shapes before, now we have demonstrated about 11 surface developments there, and there are no longer any questions in the children's minds. No questions remain in their minds at all. Look, here is a surface development, or let it be a square, it doesn't change through 90° so that is the square's common feature."*

Hatice, made similar statements for the "learning through doing and experiencing" code in the "role of DGS use in teaching and learning" category prior to implementation, but it is noteworthy that her explanations were shorter at that time.

It should be noted that there was no opinion before the

application for this code, but three of the four teachers expressed their opinions after the application and they supported their opinions with their experiences during the application. The pre-service teachers have pointed out the advantage of offering several examples of the same geometric figure. In addition, they also explained that this advantage makes it possible to process several openings without loss of time.

While the code "making students feel that mathematics is valuable", was not present prior to the implementation process, this code was added in line with the pre-service teachers' views, and the pre-service teachers named Hatice and Berke presented their opinions. The views of the pre-service teachers for the "making students feel that mathematics is valuable" code are as follows:

Hatice: *"I saw this at university, for example, we made squares with the Cabri program for the first time there. There is definitely a logic to this, you see, 90° really doesn't change, or look, the sides don't change, they are the same; even I was surprised in the second and third years of university. When children see this, they will show appreciation towards mathematics, they will give value to it, I believe."*

It is seen that Hatice was of the view that the use of DGS in classes can make students feel that mathematics is valuable, and that even they themselves expressed the view that they were affected by the situation. The pre-service teacher named Berke mentioned that when mathematical operations are carried out with their causes, it will be meaningful for students and they will feel the value of mathematics.

Berke: *"Mathematics is not like it used to be, that is to say, now everyone says 'I perform this function, but why do I perform it?' Mathematics is life, mathematics is everywhere now and they are really able to see this."*

The "Permanence and facilitation of learning" code was examined under the code "facilitation of learning" prior to implementation, and the pre-service teachers named Hatice and Miray gave their views, while after the implementation process, Miray, Elif and Berke expressed their opinions. The pre-service teacher named Berke stated that DGS programs, since they concretise what is taught and appeal to more than one of the students' senses, make the things that are learnt permanent, and therefore facilitate understanding.

Berke: *"They will see what is in front of them directly and concretely. When calculating surface area, the students will understand and learn why in fact we have performed that function. With the expansion of the surface, they see directly why we have made that shape, for example, in our day there were no such programs and a formula was given, we did it with a formula, if we didn't l earn the*

formula we couldn't do it, and we couldn't understand why it was like that. The children see this along with its cause, they know why they perform that function."

The pre-service teacher named Miray was of the opinion that use of DGS in lessons enables permanence and facilitation of learning by students. Miray explains her views on this topic very briefly before the application, but after the application, she explains her views with different expressions as shown in the excerpt below.

Miray: *"Because of these programs, they perceive things faster and more easily. […] I am talking about a visual material, namely Cabri. When using this material, from a visual point of view, or going to the board and it's a question of an activity, there's an animation, reforming a shape and by doing this it makes it more permanent. Students do not easily forget when lessons are given with such material and their learning is made easier since they are still in 5th grade and making something abstract from something concrete makes things difficult for them. If we can make sure these prisms are animated in their imaginations and support this visually by doing them on the board, the students will have something very permanent there. […] The lessons are very suitable for the students and they have very nice lessons. They understand things more quickly. For the prisms, seeing the surface developments and their reformed shapes with Cabri, even doing this themselves, is very beneficial for their perception of the subject."*

Miray mentioned that learners' motivation increased due to the visual and dynamic properties of the software Cabri. In addition, she explained that students easily understood abstract concepts since they were active during the lessons.
Elif stated that especially when the students saw the geometric shapes converted with Cabri 3D, it was beneficial for them as students. Elif's views based on her experiences are as follows:

Elif: *"I have seen the benefit of two-dimensional shapes, for example when we do them with the coordinate system, and it's lovely from a visual angle. Yes, seeing the conversion of prisms with three-dimensional Cabri 3D is also a very nice thing, it's lovely to see the rear surface if you haven't got material with you. Generally, I cannot say that it wasn't useful."*

The "preventing erroneous mental representations" code was also added after the implementation process, and the pre-service teacher named Berke stated his opinions. Berke was of the opinion that when material is not presented in a concrete way to students, and abstract subjects are taught, students will think according to their own imaginations and therefore, errors or deficiencies may occur in their learning.

Table 3. Positive aspects of operations with the use of DGS.

Category	Code	Relevant pre-service teachers prior to implementation	Relevant pre-service teachers following implementation
Positive aspects of operations with the use of DGS	Efficient use of time	Elif, Miray	Berke, Miray
	Facilitation of teaching	-	Berke

Berke: *"Normally if I teach squares, prisms, or rectangles, etc. to children orally for two or three hours, maybe even at the end of that period the subjects will not be formed in the children's minds, since I explain to them but maybe in each of their minds something else will be formed; they will interpret things according to their own worlds. But this will be concretised and will limit their imaginations a little. Everyone's imagination is different, everyone can produce a different product in their minds, but now this can be limited as we don't direct them to wrong ideas. For pointing them in the right direction, it's a good thing."*

Pre-service teachers expressed shorter and more positive views before implementation. On the other hand, it was noticed that after implementation they often used a wider variety of expressions about their experiences. The codes revealed as a result of the content analysis for the second main category, named "positive aspects of operations with the use of DGS", and the distribution of pre-service teachers with regard to the codes, are shown in Table 3.

For the category named "positive aspects of operations with the use of DGS", from the pre-service teachers' views, only the code "efficient use of time" was found before implementation, whereas after implementation, the code named "facilitation of teaching" was added to this. It was seen that Hatice did not have any view related with this category when considering her expressions before and after implementation. For the "efficient use of time" code, Miray expressed opinions prior to implementation and stated his view on this category following implementation.

The pre-service teacher named Elif presented views on the "efficient use of time" code in the "positive aspects of operations with the use of DGS" category prior to implementation, whereas after implementation, she did not give any opinion in this category. While no comments were made by the pre-service teacher named Berke for this category before implementation, it was seen that he made comments on the "efficient use of time" and "facilitation of teaching" codes following implementation. For the "efficient use of time" code, while the pre-service teachers named Elif and Miray expressed opinions before implementation, the pre-service teachers named Berke and Miray stated their views on this after implementation.

Berke: *"As these are abstract subjects, they are really difficult subjects to concretise in the children's minds.*

Since I presented these visually to the children, I didn't have to deal with them again and again. I saved some more time."

Berke also argued that the visualization feature of the DGS facilitates the concretisation of the abstract concepts by the students, which leads, according to him, to a faster learning.

Miray: *"In terms of teaching, we have used the time period correctly"*

Miray showed a similarity in his opinions before and after the implementation. According to Miray, by using DGS in teaching, teachers will be able to correctly use the didactic time, be planned and programmed. For the code named "facilitation of teaching", which was added in the light of the pre-service teachers' views post implementation, it was seen that the pre-service teacher named Berke expressed views on this.

Berke: *"I have made my teaching a little easier. Indeed, from my point of view, while teaching, it has become more comfortable. Otherwise, it would have been more difficult."*

Berke said that the use of DGS has contributed positively to his teaching, it has facilitated his way of teaching. In the study, the codes revealed as a result of the content analysis for the category named "negative aspects of operations with the use of DGS", and the distribution of pre-service teachers with regard to the codes, are shown in Table 4.

According to the analysis of the views of the pre-service teachers following implementation, the codes "large class sizes", "lack of physical facilities in the schools", "worrying about keeping up with the subjects", "inadequacy of teachers", and "preparation period of teachers prior to lessons" were determined for the category named "negative aspects of operations with the use of DGS".

The codes common to the periods before and after implementation for the category named "negative aspects of operations with the use of DGS" were seen to be "lack of physical facilities in the schools" and "inadequacy of teachers". In the light of the views of the pre-service teachers following implementation, the codes "large class sizes" and "worrying about keeping up with the subjects"

Table 4. Negative aspects of operations with the use of DGS.

Category	Codes	Relevant pre-service teachers prior to implementation	Relevant pre-service teachers following implementation
Negative aspects of operations with the use of DGS	Large class sizes	-	Hatice, Elif
	Lack of physical facilities in the schools	Hatice	Hatice, Elif
	Worrying about keeping up with the subjects	-	Hatice
	Inadequacy of teachers	Elif	Hatice
	Preparation period of teachers prior to lessons	Elif	Miray

were added to the category "negative aspects of operations with the use of DGS". After implementation, in the views of the pre-service teachers, the code named "loss of time" in the use of DGS was removed, as no data for this code was encountered.

The pre-service teacher named Hatice, while stating her views on the "loss of time" and "lack of physical facilities in the schools codes for the "negative aspects of operations with the use of DGS" category in the lessons prior to implementation, expressed opinions on "large class sizes", "lack of physical facilities in the schools", "worrying about keeping up with the subjects", and "inadequacy of teachers" for this category following implementation. The pre-service teacher named Berke, whilst expressing his opinion about the "loss of time" code in the "negative aspects of operations with the use of DGS" category prior to implementation, was not seen to make any comment related with this category in his opinions after implementation. This pre-service teacher stated that he did not see any negativity or disadvantage in the use of DGS.

The pre-service teacher named Elif, stated her views on "inadequacy of teachers", and ''preparation period of teachers prior to lessons'' in terms of negative aspects of DGS use in the lessons before implementation, whereas she did not mention anything about these subjects after implementation, and expressed her opinions on the "large class sizes", and ''lack of physical facilities in the schools''codes following implementation. The pre-service teacher named Miray, who did not express any views related with the category "negative aspects of operations with the use of DGS" prior to implementation, expressed opinions on the "preparation period of teachers prior to lessons" code for this category in her comments after implementation.

The pre-service teachers stated that because the class sizes were too large for use of DGS in lessons and that it could not be carried out for each student, loss of interest in lessons occurred. They were of the opinion that if a tablet had been available in front of each student for carrying out the activity, it would have been much more productive. ''Large class sizes'' and ''lack of physical

facilities in the schools'' codes are discussed together in the light of the views of the pre-service teachers. Examples of the pre-service teachers' comments related with this view are given below:

Hatice: *"Our classes are very crowded; if only I do it on the computer, I cannot maintain their interest, but if they dealt with the tablets themselves, as they are coloured, their attention would be drawn and the one beside the other will say things like 'I've done it, you couldn't', and this will encourage the other and so the situation will be turned to our advantage. […] It's difficult to do it on the board, while I deal with it, they can't and they start chatting right away. If everyone does it themselves it can be much more effective. If each student has his/her own tablet and everyone can do it, then no disadvantages will remain, in short."*

Before the implementation, Hatice mentioned the problem of finding computers for all students; which had been coded in the category '' lack of physical facilities in the schools ''. After the implementation, as she used the common computer of the classroom via a video projector, she expressed her fears about student motivation. According to Hatice, students would have less problem concerning the motivation if they worked with concrete materials.

Elif: *"As a teacher, I close the surfaces of the prism, but it seems to me that if there was a tablet in front of each student for such an activity and if they could all perform that action at the same time, it would be productive. When some of them come up to the board, it gets crowded there, which means that the children want to play this themselves, so if that was possible it would be learnt better, it seems to me. They will experiment themselves, as they experiment with so many things that for technology they only seek to research into things."*

Elif also said that students are very interested in technology. According to her, when students are on the board, the interest that is scattered in the classroom begins to revive. Elif also expressed that if each student

has its own tablet, students will complete activities individually and activities will become more meaningful for students. Another code for which the pre-service teachers expressed views on the negative aspect of DGS use was determined as "worrying about keeping up with the subjects". The pre-service teacher named Hatice mentioned the intensiveness of the teachers' syllabus and was of the opinion that when lessons were conducted in this way, she could not keep up with the subjects. The pre-service teacher mentioned that she was giving importance to the constructivist teaching model and that she wanted to follow this model. The views of this pre-service teacher on the "Worrying about keeping up with the subjects" code are as follows:

Hatice: *"We say 'let's use constructivism', but if we use it one lesson lasts two lessons, and Cabri is like this; if I use it I have to give two lessons only for this; I will fall behind my fellow teachers. Okay, this is not important either but we do the exams together in this way and they say, 'why are you behind us?' In fact, if the state gave us a bit more chance with regard to this, if, for example, they told us that square prisms are a really important subject… So, they will show us the Cabri programs or it is down to the teacher's own style. If they said, 'let's give two or three weeks to this', I could do this, but in order to keep up with the syllabus I can immediately omit some subjects. Not being able to keep up with the subjects is a disadvantage, in my opinion."*

Before implementation, the pre-service teacher named Elif stated views on the "inadequacy of teachers" code, but after implementation, the pre-service teacher named Hatice expressed her opinions by relating her own experiences. This pre-service teacher, starting out from her own experiences, explained that the negative aspect of operations with the use of DGS may derive from inadequacy of the teacher, as follows:

Hatice: *"There were a lot of surface developments for rectangular prisms, and I could not even do two of these on the board. As I didn't have such a program on my computer, I could not repeat them, and the children, because I couldn't do it this time, changed the page. I think this was a disadvantage from my point of view. I think I displayed negative behaviour here."*

Prior to the implementation process, no pre-service teachers expressed their opinions on the "preparation period of teachers prior to lessons" code, whereas after the implementation period, the pre-service teacher named Miray stated her views.

Miray: *"We have to set up those programs one by one beforehand, the teacher has to continually prepare those materials one by one in the evenings, and before the lessons, detailed work has to be done."*

CONCLUSION AND SUGGESTIONS

In this study, an attempt has been made to determine the views of primary school mathematics pre-service teachers towards their experiences of the use of DGS in teaching, following their practicums carried out by using DGS in authentic classroom situations.

Following the results obtained, the views of the pre-service teachers related with their experiences of the use of DGS were separated into three categories, namely the "the role of DGS use in teaching and learning", "positive aspects of operations with the use of DGS", and "negative aspects of operations with the use of DGS" categories.

As a result of the study, it was revealed that the pre-service teachers, following the theoretical lessons that they had in the education faculty and prior to their actual teaching practice, gave more limited opinions for all three categories, whereas during the teaching practice period for DGS, following its use in real classroom situations, they expressed more features of the use of DGS. In fact, it was seen that pre-service teachers often expressed their views by giving examples from their own classroom experiences.

The pre-service teachers, in relation to their real classroom experiences, expressed their views on the features "concretisation and visualisation", "possibility of presenting many examples", "making students feel that mathematics is valuable", "permanence and facilitation of learning", and "preventing erroneous mental representations" with regard to the role of DSG use in teaching and learning.

Yet, prior to using DGS in the classroom, these pre-service teachers had given importance only to the "concretisation and visualisation" and "permanence and facilitation of learning" characteristics. In some researches examining the views of pre-service teachers with regard to computer use in mathematics learning and teaching, similar results like ensuring permanent learning in students, visual quality and concretisation were also obtained (Corbalan et al., 2010; Jassó, 2004; Karatas, 2011; Olkun et al., 2005; Tatar et al., 2014; Usluel and Umay, 2005; Yildiz et al., 2012).

In this study, the future teachers also expressed the view that the DGS would give students the idea that mathematics is valuable. According to the results obtained, following implementation, the pre-service teachers gave their opinions that DGS made positive contributions to geometry lessons in terms of "efficient use of time" and "facilitation of teaching", whereas before implementation, they had mentioned only the "efficient use of time" contribution of DGS. In the literature, several studies report that teachers and pre-service teachers were aware of the positive contributions of use of DGS and that they have expressed views on this (Yesilyurt, 2006; Ayvaci et al., 2007). In this context, the results of this study are in line with the results in the literature.

Another result of the study was that the pre-service teachers, after implementation, expressed their views on several negative aspects related to operations with the use of DGS. These negative aspects expressed by the pre-service teachers cover the subjects "large class sizes", "lack of physical facilities in the schools", "worrying about keeping up with the subjects", "inadequacy of teachers", and "preparation period of teachers prior to lessons". While the "lack of physical facilities in the schools", "worrying about keeping up with the subjects", and "preparation period of teachers prior to lessons" factors were mentioned only in the interviews following implementation, the "large class sizes" and "inadequacy of teachers" factors appeared in the interviews both before and after implementation.

The studies carried out, despite mentioning negative aspects of DGS for in-service teachers, report that pre-service teachers are not aware of negative aspects related to DGS use (Baki et al., 2009). In contrast, in this study, the pre-service teachers express quite varied opinions on the negative aspects of DGS. In may be considered that in this study, this difference appeared due to the fact that the views of the pre-service teachers were taken based on their actual teaching experiences with DGS. Moreover, unlike the unsupported views of pre-service teachers prior to implementation, their post-implementation views changed based on their classroom experiences. Indeed, after the implementation, the pre-service teachers criticized themselves at the level of the effective use of DGS in the classroom. This may result in a reticence in the use of DGS when they begin to practice their profession.

It can be argued that teachers' experiences in the classroom have helped to clarify their views on the DGS. Niess and Garofalo (2006) argue that experiences with the use of technology as students influence their ways of teaching once they become teachers. In this research it was brought to light that the opinions and beliefs of the pre-service teachers oriented their practice in the classroom. For example, Hatice, although she did not show a negative attitude towards the DGS and she indicated many positive features of the DGS on student learning. However, given that the high school mathematics curriculum is intensive, she expressed her anxiety about not being able to complete the programs because of the time spent on the DGS; she said that she would not use often DGS in her lessons. In this research it was found that teachers' opinions on the use of DGS in teaching had some consistency before and after their classroom experiences. Indeed, Jedeskog and Nissen (2004) also show that teachers' interests, beliefs and opinions directly influence how they build and implement their courses.

Therefore, in order for pre-service teachers, when taking their first steps in teaching, to evaluate the negative aspects of DGS together with its positive aspects, it is important for them to experience learning and teaching environments that integrate DGS in their practicum schools during their teaching practice periods. In this context, it is suggested that the training for the use of DGY in theoretical and practical courses in the undergraduate program will be more positively affect the opinions of the pre-service teachers about the use of DGS.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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[i]This study has been produced by Kardelen Günes from her Master's thesis with the guidance of Asst. Prof. Dr. Menekse Seden Tapan-Broutin

Full Length Research Paper

Assessment of in-service training activities for junior high mathematics teachers

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The current education system aimed to train active deliberative individuals who learn to learn with the adoption of the constructivist educational approach. Based on this objective, there have been significant changes in the roles of teachers. To assist the development of teachers, the Ministry of Education organizes several in-service training activities every year. The present study aimed to assess an in-service training activity organized by the Ministry for mathematics teachers based on the teacher views. The study was a case study, which is a qualitative research model. The study group consists of 12 junior high school mathematics teachers who were selected by sampling method from approximately sixty junior high school mathematics teachers who participated in the activity. A semi-structured interview form was used to collect data in the study. The present study scrutinized the expectations, experiences during the process and recommendations of the teachers about the in-service training activity they participated in, and obtained qualitative data obtained were analyzed with the descriptive analysis method. Study findings demonstrated that participating teachers mostly participated in the activity to "learn different teaching methods and techniques". Since the training activity was a "special instructional methods and techniques-mathematics" seminar, the aforementioned expectation was a priority for the teachers. Almost all participants stated that the most positive aspect of the training they attended was "to exchange information with their colleagues." Furthermore, certain teachers participating in the seminar stated that they refreshed their knowledge in the process, while others mentioned that they learned new information.

Key words: Mathematics teachers, in-service training, instructional methods and techniques, constructivism.

INTRODUCTION

The advances and innovations in the fields of information and technology during recent years introduced significant changes in the field of education (Acar and Anıl, 2009; Birgin and Gürbüz, 2008; Günbayı and Taşdenek, 2012; Sağlam-Arslan et al., 2008). As a result of these changes, new approaches could help train active, inquisitive and productive individuals with problem-solving and critical thinking skills (Acar and Anil, 2009; DiMartino et al., 2007; Sağlam-Arslan et al., 2008).

The most effective and fundamental method of keeping

up with these advances is undoubtedly "education". Countries, institutions and individuals need to prioritize education to follow these developments and maintain their knowledge base on innovations (Gül, 2000). This approach, which is based on collaborative methods and focus on constructivism (Graue, 1993) was also adopted in Turkish education system as well. However, for the constructivist approach to be successful, it was necessary to change the roles of the teachers, since changing only the curricula was not sufficient (Ayan, 1999). Because, it is the teacher that would transfer all these rapid developments to their students. The teacher is at the center of the education and instruction services. It is recognized that the quality of education in schools is associated with the teachers' professional development levels in their respective fields and teaching methods (Klinzing et al., 2002; Lewin, Guskey, 2003; 1990; Spector, 1987).

However, it is a very difficult process for teachers to follow developments in different fields and to continue their personal development based on these developments, and transfer the related knowledge to their students (Önen et al., 2008). It is known that the individual efforts of teachers who want to improve themselves are not always sufficient for their professional development (Richert, 1991). In other words, how should the teachers, who aim to educate active, inquisitive, problem-solving, critical thinking and productive individuals, develop and adapt themselves to these advances?

It is clear that the constructivist teaching approach is responsible for the increase in the responsibility and duty of the teachers. Thus, the constructivist teaching approach requires the teachers to command their field and increase the productivity of the learning-teaching process by applying different approaches and methods-techniques in their classes. Therefore, in-service training programs for teachers play a very important role in teachers' personal and professional development (Önen et al., 2008).

In-service training is the self-training or education that a professional participates during his or her professional life (Aytaç, 2007). In-service training for teachers could be defined as all related processes that enable the teachers to acquire the skills, attitudes and habits required to train the students to achieve the qualities that are the goals of education, and the professional knowledge, skills, attitudes and habits that they lack as evidenced with scientific and socio-economic facts (Budak, 1998).

In-service training, which is a part of lifelong education, aims to provide employees with the knowledge, skills and attitudes that would enable them to become more successful, productive and happy individuals in their professional lives (Yalın, 2001). Furthermore, to increase the quality of the education system and instruction, not only the teacher but all the school personnel should attend in-service training for the same purpose (Fullan, 1991).

According to Garmston (1998), the qualities of having a professional teacher identity are to possess a strong field knowledge, to have extensive knowledge on teaching methods, to have knowledge on child development and learning theories, to be sensitive about the learning styles of the students in the classroom, to have an understanding about own advantages and disadvantages about the norms and value judgments. Thus, the three fundamental elements of in-service training are:

(1) Training the teacher to acquire professional skills.
(2) Providing knowledge to enable the acquisition of these skills.
(3) Influencing the teacher behavior in the positive direction (Önen et al., 2008).

The benefits of in-service training activities for teachers are promoting professional development by increasing the scientific, educational and individual competence of teachers, promoting teachers' professional satisfaction, improving the performance of teachers, instructional material and the teaching atmosphere and conditions (Haris, 1989, as cited in Silvester, 1997).

Various previous studies frequently demonstrated that teachers should attend in-service training for better adaptation to the system (Akpınar and Ergin, 2005; Birgin, 2010; Birgin et al., 2008; Demirtaş, 2008; Kaplan, 2006; Nartgün, 2006; Özen, 2006). The Ministry of National Education also attempts to serve this purpose through several in-service training activities on a local and national basis that it organizes every year. However, the teachers' activities to transfer the things they learned in-service training and whether they remember the training content is more important than the topics instructed in the training (Mutshekwane, 1999).

Based on the results of various studies, teachers stated that they still did not receive sufficient in-service training (Bal, 2008; Birgin, 2010; Birgin et al., 2008; Demirtaş, 2008; Kaplan, 2006; Nartgün, 2006; Gökyer, 2011; Özen, 2006), and they were not competent in practicing teaching methods and techniques in particular and wanted to receive education in this field (Birgin and Baki, 2009; Çiftçi, 2010; Doğan et al., 2007; Erdal, 2007; Gelbal and Kelecioğlu, 2007; Gök and Şahin, 2009; Güler et al., 2015; Günbayı and Taşdöğen, 2012; Kramer et al., 2015). Those who organize in-service training programs should prioritize the educational needs of the participants (Wooden and Babtiste, 1990). However, the findings of the present studies did not reveal evaluations on in-service training activities for mathematics teachers.

Mathematics was always considered as a fundamental course for the comprehension of the life and the world, and production of knowledge. The instruction of the mathematics course is as significant as the course itself. Because, one's approach to mathematics is associated with how mathematics was learned by this individual (Hare, 1999). Therefore, mathematics teachers are significant in learning mathematics. Thus, it could be

Table 1. Participant demographics.

Teachers	Gender	Professional seniority (year)	Education level	Place of duty	Previous in-service training	Source of the information about the activity
T1	Female	9	Undergraduate	Tunceli	No	Province Nat. Ed.
T2	Male	12	Undergraduate	Artvin	Yes	School admin.
T3	Male	10	Undergraduate	Trabzon	Yes	Mebbis*
T4	Male	7	Undergraduate	Kırıkkale	No	Mebbis*
T5	Male	17	Undergraduate	Aydın	No	School admin.
T6	Male	16	Undergraduate	Isparta	Yes	School admin.
T7	Male	11	Undergraduate	Sivas	No	Official letter
T8	Male	9	Graduate	Zonguldak	No	Mebbis*
T9	Female	7	Graduate	Hatay	No	Recommendation
T10	Female	6	Undergraduate	Kayseri	No	Mebbis *
T11	Male	5	Undergraduate	Sakarya	No	Recommendation
T12	Female	6	Graduate	Malatya	No	Recommendation

*Ministry of education information systems.

argued that it is very important for teachers to organize their classes to guide the students towards knowledge instead of directly conveying the knowledge, and the use of different methods-techniques and approaches during this process. However, previous studies demonstrated that teachers did not have adequate knowledge on different methods, and techniques that would allow their students to participate actively in the classroom (Gönen and Kocakaya, 2006).

The present study aimed to obtain the expectations, views and recommendations of mathematics teachers who participated in the national scale "in-service training activities" organized by the Ministry of National Education for Mathematics teachers.

METHODOLOGY

The researchers tried to collect detailed data about "teaching methods and technics (mathematics) for the purpose. The research is a qualitative case study. A case study deals with analyzing one or more cases in their context (environment, time, etc.) in details (Yıldırım ve Şimşek, 2011). In this research, the training activity in question was analyzed in its own environment and time in details. In the present study, the case was the in-service training activity attended by approximately sixty junior high school mathematics teachers. As sampling method, extreme or deviant case sampling was chosen. This method is preferred for researches containing efficiency of a single program, for example, of an in-service training program. To assess the efficiency of the in-service training program, the researcher composes the sampling of the participants having achieved high success in the training program, and the ones discarded due to their failure. Thus, the researcher obtains rich and detailed data about the efficiency of the program (Yıldırım ve Şimşek, 2011). In this research, all the teachers in the target population of the study who volunteered to share their views and criticisms about the program were included into sampling. The teachers who criticized the program are employed in various provinces. In this way, the sampling also has maximum variation

sampling method characteristics.

Participants

The study group included 12 junior high school mathematics teachers selected by extreme or deviant case sampling from the population of teachers that participated in the aforementioned training activity. The views of each teacher's opinions were analyzed in-depth to determine the similar views among the teachers, and to reveal different dimensions of the problem. To keep the identities of the teachers confidential, the teachers were coded as "T1", "T2", "T3", "T4", etc. based on the interview order (Table 1). Among the teachers that participated in the study (N = 12), 4 were female (N = 4), eight were male (N = 8) and three were with graduate (N = 3), and the others were with undergraduate (N = 9) education. The professional seniority of the teachers varied between 5 and 17 years. The majority of teachers (N = 9) did not participate in an in-service training activity previously. All teachers were employed in different provinces. Teachers mostly (N = 4) chose to participate in this training via the in-service training application module found at Ministry Information Systems web site. A number of other teachers (N = 3) participated in this training due to the recommendation of their colleagues (N = 3), and three teachers due to the information provided by the related school administrations, one teacher learned about the training via an official letter and one teacher participated in the study due to a telephone call from the Provincial National Education Directorate

Data collection instrument

A semi-structured interview form was used in the interviews conducted in the study. Furthermore, the course textbooks utilized in the in-service training process were used to increase the richness and credibility of the data within the scope of the document review. In the semi-structured interview form, three main questions were posed:

(1) What are the expectations of mathematics teachers that participated in the in-service training?
(2) What were the views of mathematics teachers on the training

process?
(3) What were the recommendations of mathematics teachers about the training process?

Data collection

All teachers that attended the seminar were informed by e-mail. and interview forms were sent to 12 teachers that volunteered to participate in the study. Written answers were received from the teachers and communication channels with the teachers were kept open to achieve more detailed and clear answers via telephone when necessary.

Data analysis

Qualitative data collected in the study were analyzed with descriptive analysis. "According to this approach, the data obtained are summarized and interpreted based on predetermined themes" (Yıldırım and Şimşek, 2008). After the study, data were coded separately by two researchers, a common code and theme list was formed by comparing the resulting code and theme lists. Then, all data were re-coded by both researchers based on the determined list. Statements that were considered to be used in direct quotations were identified and included in the findings section. Analyzes were also reviewed by a third colleague with experience and knowledge on the topic of investigation for consistency of the determined themes. Furthermore, the participants' approval about the obtained findings was obtained to improve the internal validity of the study. To keep the identities of the participants confidential, the teachers were coded as "T1" - "T12", based on the interview order.

FINDINGS

Expectations of junior high school mathematics teachers that participated in the in-service training

Expectations of junior high school mathematics teachers that participated in the in-service training from the training are presented in Table 2. According to the views of the participants, the teachers mostly preferred to participate in this particular training to "learn different methods and techniques". Since the training activity was a "special instructional methods and techniques-mathematics" seminar, the aforementioned expectation was a priority for the teachers. This was followed by the desire "to see new places." Teachers stated that they preferred this particular training due to its location, and it was organized during the summer break. Participants considered "sharing knowledge and experience of the academics who are experts in their field" significant. The fact that course administrators were academicians and the participants' desire to learn new information from them and share their experiences were presented among the reasons for joining the seminar. On the other hand, certain participants stated that they hoped the seminar would contribute to "professional development" and their professional knowledge on the field. While certain participants expressed their expectation to learn practical information about "conducting practical activities", certain others stated that they expected to "share information

and experiences with colleagues".

Views of mathematics teachers on the in-service training process

Based on the participant opinions, the negative and positive views of mathematics teachers on in-service training process are presented Tables 3 and 4, respectively. Participants noted certain negative situations they experienced during the seminar as follows:

The most negative aspect was "theoretical presentations and not enough practice" according to the participants.

Teachers expressed their expectations that new methods and techniques should have been demonstrated in the classroom environment, but the instructions were predominantly theoretical. Several teachers also stated that "the seminar duration was short for the seminar content". The teachers observed that the seminar provided too much theoretical knowledge and expressed that either the content should be reduced or the duration should be extended. Teachers complained that "the seminar content was not well planned", and stated that they experienced an educational process which was mostly theoretical and the content should be improved with practical activities and to be laconic. Another negative opinion was that "the spaces where the seminar was organized were technically inadequate". They stated that especially in activities that required the use of computer laboratories, two or three teachers had to share a computer and that caused problems, and certain teachers stated that "there was a cleanliness problem in the accommodations". They claimed that beds and armchairs were very old, rooms were not cleaned daily, etc. Almost all of the participants considered "exchange of information with colleagues" as the most positive aspect of the training they attended. Teachers stated that they shared their experiences with colleagues from all over Turkey, and learned new things from them. Similarly, they mentioned "exchanging information with instructor professors in the training". They talked about the importance of having the opportunity to chat with academicians outside the class, and share their experience and knowledge. Furthermore, certain teachers stated that participating in the seminar refreshed their knowledge, while others mentioned that they acquired new information. Teachers indicated that they recalled certain theoretical information that they have learned during their undergraduate studies, learned about the new computer software like Geogebra, and obtained information about this software.

Recommendations of mathematics teachers on the in-service training process

Based on the participant opinions, recommendations of

Table 2. Expectations of junior high school mathematics teachers that participated in the in-service training.

Expectations	Participants	Sample statements
Opportunity to learn different methods and techniques	10 (T1, T2, T3, T5, T7, T8, T9, T10, T11, T12)	T8: "I was following the instructional methods and techniques in mathematics instruction after graduation from college. I thought the seminar would provide a more scientific experience"
Visiting new locations	7 (T1, T4, T5, T7, T10, T11, T12)	T7: "It is important for me to be some place where I can spend good time… I was expecting to see a new space, a new province. I had the chance to see the beautiful scenes and historical places around"
Sharing the knowledge and experiences of expert academicians	6 (T1, T4, T5, T6, T8, T12)	T1: "I was excited about the face to face training by college professors. I thought I could learn concrete methods that I could utilize in the class"
Conducting practical activities	6 (T1, T2, T3, T9, T11, T12)	T2: "When the training was over, I expected to lean more equipped techniques. I expected to come up with solutions that could be applied in actual situations we experience in the classroom"
Professional development	5 (T4, T7, T8, T10, T12)	T10: "I was interested in special instructional methods and techniques. I thought these would be beneficial to conduct better instruction"
Sharing information and experiences with colleagues	4 (T4, T5, T6, T12)	T6: "I thought it would be good opportunity to share information with colleagues who came from all corners of Turkey"

Table 3. Negative views of mathematics teachers on the in-service training process.

Negative views on the process	Participants	Sample statements
Presentations were mostly theoretical and were not sufficiently practiced	9 (T1, T2, T4, T5, T7, T8, T9, T11, T12)	T3: "In my opinion, I expected to find things I could apply in the classroom. What I observed in the seminar were the things I already conducted"
The duration of the seminar was too short for the content	8 (T2, T5, T6, T7, T8, T9, T10, T12)	T9: "The seminar content was current and adequate for the objective. However, the information was provided in a very short period of time. Instead, I would have preferred lesser number of topics should be instructed in more detail"
The content of the seminar is not well planned	6 (T2, T3, T5, T7, T11, T12)	T7: "Seminar content was current but not effective. Insufficient number of examples were provided. But when you think about it, maybe that was the only content that could be planned for that time period"
Technical inadequacies in the seminar spaces	6 (T1, T5, T7, T8, T9, T12)	T8: "…It was technically insufficient. Computer lab was inadequate. There was a projector but it was inadequate. In-Service Training Institutes should contain smart boards, etc"
Accommodation issues	6 (T5, T6, T7, T9, T10, T11)	T11: "They should pay more attention to cleanliness in the accommodations. For instance, the bed sheets and towels should be changed at least once every two days, if not every day"

Table 4. Positive views of mathematics teachers on the in-service training process.

Positive views on the process	Participants	Sample statements
Sharing information with colleagues	11 (T1, T2, T3, T4, T5, T6, T8, T9, T10, T11, T12)	T10: "The training was great. We got to discuss the problems we experienced in mathematics instruction with our colleagues who worked in other cities"
Sharing information with the professors who instructed the training	6 (T2, T4, T6, T8, T9, T12)	T9: "The professors were masters on the topic. They treated us as colleagues, not as students. This was a factor in the success of the training that lasted a short period of time. We were able to ask them all questions we wanted to ask. And they replied all sincerely"
Learning new information	4 (T4, T6, T7, T10)	T7: "I learned about the different programs used for computer-aided mathematics education… it was stimulating for the research I conducted later"
Refreshing old information	1 (T10)	T10: "We had the opportunity to remember the instructional methods and techniques utilized in math and observed the application areas"

mathematics teachers on the in-service training process are presented in Table 5. Participants made several recommendations. These recommendations could be listed as follows;

Teachers recommended inclusion of more practical activities, explanation of the application of the methods and techniques that were addressed theoretically in the classroom, consideration of physical facilities and their improvement to be suitable for seminars, improvement of technological equipment, particularly the computers, sharing preliminary information about the future seminars, providing not only the name of the seminar but information about the instructors, related methods and techniques before the seminar and during the application process, improved use of the material, availability of more material on mathematics education during the seminar, necessity of the availability of material associated with mathematics education in the seminar and information on how to use these material at schools, effective planning of content, planning to provide more practical and less amount of content for the teachers in a shorter period of time, inclusion of technology-assisted methods, information about new technology-assisted methods with the introduction of technology to education as a result of smart board, tablet, etc. use, sharing sample applications, sharing the practical applications teachers utilize in their classes with colleagues from all over Turkey, or to watch these applications via videos, sufficient content and time reserved for that content, instead of instructing more content in less time, planning the content with an approach that values quality rather than quantity, reducing number of participants, forming smaller groups in the seminar if technological equipment are insufficient, to continue the seminar with the same individuals, to achieve a more productive training, and the same group should be provided with a more qualified training at a

different time to sustain the education.

RESULTS AND DISCUSSION

In-service training organized by the ministry for teachers is undoubtedly very important. The creativity and benefits of the in-service training are reduced if they are conducted without determining the needs and goals, and the requirements of the participants, and the outcomes will not be positive (Taymaz, 1981).

In a study conducted by MEB (2008), the in-service training requirements of mathematics teachers were attempted be determined. 62.3% of the 3.134 mathematics teachers who participated in that study expressed that they were in need of training in teaching strategies, methods and techniques in mathematics education, and 59.5% of the same teacher group needed training on mathematics program measurement, assessment methods and techniques. Thus, the in-service training activity that was the topic of the aforementioned study aimed to eliminate the problems of teachers related to teaching methods and techniques. However, findings of the present study indicated that the training did not adequately meet some of the expectations (conducting practical activities, learning different methods and techniques) of teachers.

Erdem et al. (2006) conducted a nationwide survey, and found that teachers did not consider themselves competent in using instructional methods. Yıldırım and Demir (2003) reported that teachers in primary and secondary schools use mostly lecture techniques in their classes, utilized problem solving, question-answer technique partially, and did not use presentation, sightseeing-observation, group discussions, case study, drama, brainstorming method and techniques sufficiently.

Also, in their study, Arıbaş and Göktaş (2014)

Table 5. Recommendations of mathematics teachers on the in-service training process.

Recommendations	Participants	Sample statements
Applicable original activities	7 (T1, T2, T3, T4, T9, T10, T12)	T2: "In my opinion, seminars should not be planned with a 20-30 years old approach and more active, for examples methods where we could play with children should be developed and these should be unique and dynamic"
Consideration and improvement of physical facilities for seminars	5 (T7, T8, T9, T11, T12)	T9: "Number of computers we used for Geogebra application were quire insufficient. Several teachers were not able to use the application. For this purpose, technical and physical facilities should be improved"
Sharing preliminary information about the training	5 (T6, T7, T9, T11, T12)	T7: "Detailed information should be provided to the participants prior to training (who will make the presentation, what are the course topics, what are the prerequisites, what should we research to prep for the training…)"
Improvement of material use	5 (T4, T5, T8, T9, T12)	T8: "Material that could be sued for mathematics instruction were inadequate. A set of mathematics course instructional material could be provided for these types of courses"
More effective planning of the content	4 (T2, T6, T7, T12)	T12: "The content should be less dense. More practical and applicable methods should be instructed to the teachers"
Inclusion of technology-supported methods	4 (T5, T8, T11, T12)	T11: "Instead of ordinary information and applications, investigation and presentation of really useful and practical techniques would be more productive. Simply, our classrooms are supported by technological arguments, I desire to attend trainings that would reflect these developments"
Sharing examples of well-done practices	3 (T1, T4, T12)	T1: "If the topics are instructed using methods and techniques that simulate the classroom conditions or visual material that reflect the application of other teachers who achieved positive outcomes are presented, it would be better"
Adequate content and time reserved for that content	3 (T8, T9, T12)	T9: "If the content is dense, the duration should be longer. In fact, instead of so much content, it would be better for us if less number of topics are addressed but in more detail"
Less number of participants	2 (T7, T10)	T10: "It would have been better if there were smaller groups, especially for the computer application"
Extending the same seminar with same individuals	1 (T8)	T8: "Special Instructional Methods and Techniques Seminar was generally positive and beneficial. The seminar could be extended with a second step where teachers who participated in the seminar could train other teachers in their regions"

demonstrated that mathematics teachers did not have adequate knowledge about new methods and techniques and that they do not have enough knowledge about new methods and techniques. In addition to that, they found that the teachers need more in-service training, however

previous trainings they attended did not satisfy their expectations. In short, similar studies demonstrated that teachers had inadequate knowledge on new methods and techniques and required in-service training, however they experienced certain problems with in-service training

programs they attended. In another study, Özen (2006) obtained similar findings and found that in-service training of primary school teachers was useful and necessary, however problems such as the theoretical nature of the instructions, the lack of or insufficient practical applications were experienced in in-service training.

In a study by Uçar and İpek (2006), it was found that administrators and teachers in elementary schools considered that in-service training was necessary but did not consider the in-service training programs in Turkish education system effective. In the present study, the perception of the teachers created by the training content, experienced problems and the technical facilities available in the training settings was also important. Because, these perceptions could affect the participation of the teachers to future trainings negatively.

The teachers who participated in the seminar were satisfied about the exchange of information with their colleagues and academicians, learning new and refreshing the old information during the seminar. These results were a part of the contributions provided by the in-service training for the teachers. After the study, participants provided several recommendations. Among these recommendations, the most frequently mentioned were the need for practical activities in in-service training programs.

In a study conducted by Saka et al. (2007), a practical seminar activity was organized for science teachers, and the authors attempted to determine whether there was a difference between the knowledge of teachers on instructional methods and techniques before the application and after the application while the data collected in that study demonstrated that the knowledge levels of participating teachers significantly improved after the seminar. Because, the authors initially provided theoretical information on the instructional methods and techniques, and the constructivist approach to the participants of the in-service training, however, this was followed by practical activities. During the application process, the authors monitored the work and provided feedback for the teachers about their mistakes.

In the study conducted by Önen et al. (2009), they attempted to determine whether there was a significant difference between methodological-technical knowledge of Anatolian Teacher High School teachers that participated in in-service training before and after the training, and it was determined that methodological-technical knowledge and knowledge on constructivist approach of the teachers improved significantly after the training. This and similar research results demonstrated that practical and well-planned in-service training activities instructed by experts could be very beneficial.

The in-service training content should be renewed and more qualified training settings should be created based on the findings of the present and other studies conducted on the field and the recommendations of the teachers. Furthermore, it was further observed that the studies conducted on mathematics teachers in the field were rather limited. It could be argued that there is a need for further studies, especially on evaluating the quality of in-service training.

The participant teachers mostly complained that the activities were mostly theoretical and lacked application activities. Kanlı and Yağbasan (2001) as well found that the participants in an in-service training program for physics teacher pointed out that they could not perform the experiments in the program in their own schools. They also added the most significant outcome of the in-service training programs was the opportunity of exchanging their experiences with the teachers from various districts of Turkey. Teachers participating in the program suggested the activities should be more application-oriented, and more math-teaching materials should be used.

RECOMMENDATIONS

Teacher expectation from the in-service training program and their views differed widely. Some teachers, for example, pointed out that they had participated in the program hoping to learn some new methods and techniques to employ in mathematics teaching, but found the content of the program not organized well, hence, did not serve the purpose. However, they appreciated the opportunity of exchanging views with their colleagues, visiting new places at the end of the program. Following suggestions were developed in the light of the results of the research;

(1) The skills to be acquired through the programs should not be limited with the theoretical ones but be in company with their applications.
(2) In-service training programs should be designed in accordance with the teachers' needs.
(3) In-service training programs should be long enough.
(4) The content of in-service training programs should be updated.
(5) Application opportunity and environments should be offered to the participants congruent with the content of the program. The facilities allotted to these kind of activities should be renewed and technically updated.
(6) Professional development of the teachers participating in-service training programs should be monitored and supported.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Full Length Research Paper

Examining teaching of professional concepts in teacher training and investigating students' cognitive structures regarding professional concepts

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The study aims to determine education faculty students' cognitive structures regarding professional concepts, and to reveal the views of the students and faculty members about conceptual teaching. The participants of the study, which was designed as a case study, were determined using the criterion sampling method. In the study, which was carried out with a total of 69 education faculty second grade students and with one faculty member responsible for the course of Introduction to Educational Sciences, Word Association Test and semi-structured interview forms were used as the data collection tools. The results of descriptive analysis demonstrated that the concept in which the students had the lowest level of misconception was the concept of curriculum, and that the concept of education was the one with the highest level of misconception and with the most superficial knowledge. In addition, the data obtained by interviews were analyzed with inductive content analysis. It was found that the teaching-learning process carried out in relation to professional concepts contributed to professional competency; that factors like use of learning strategies and different information sources supported the process; and that the students' misconceptions and the faculty member's use of a single teaching method made the teaching process difficult. In the study, it was concluded that it is necessary to give examples related to concepts, and to use various teaching methods and techniques for the improvement of the process.

Key words: Cognitive structure, professional concept, teacher training.

INTRODUCTION

In learning, which has a spiral structure, preliminary learning could not only constitute the basis of subsequent learnings but also contribute to correct construction of these subsequent learnings. To speak generally, learnings regarding a certain subject area have a direct relationship with the learnings of concepts covered by that subject area.

According to Vygotsky (1986), concept is a part of the representation system which includes both the level of abstraction and the degree of the relationship for the formation of the real structure of other concepts. This multi- dimensional representation supports the development of an inter-connected hierarchy which relies on current concepts to make it easy to explain new

concepts with examples (Wellings, 2003).

According to Merrill (1983), who defines concept as the building stone of human thought, concepts are regarded as the whole of symbols, phenomena and objects sharing common features and using the same name. Klausmeier (1992) defines concept as an intellectual structure which represents organized information about anything. In this respect, when the definitions of concept reported in related literature are examined, it is seen that concept refers to an abstract unit of thinking as well as to a kind of classification which involves the actions of separating in accordance with differences and combining in accordance with similarities.

Individuals form concepts from their own ideas that they use to understand natural phenomena which they observe from their environments during their daily life experiences (Alwan, 2011; Faiz and Ergin, 2014). Learning the concepts correctly and completely, which are fairly important for us to give meaning to everything including our world, the life, people, events and the universe is also essential for our current and future learnings. Concepts help the individuals form the basic cognitive structures in their minds and learn new information significantly (Faiz and Ergin, 2014). The fact that learning is a life-long continuous process for all ages and that educational environments are areas where the actions of learning and teaching are carried out in a planned and systematic manner increases the importance of conceptual teaching and learning in these environments.

In a study conducted by Erdener (2009), who compared the views of Vygotsky and Piaget about intellectual and linguistic development, Vygotsky defines daily concepts as those which occur spontaneously and scientific concepts as those which occur non-spontaneously and which are taught in school or family environment, and are subjected to conscious processing. According to Vygotsky, once the individual starts grasping the concept consciously, then previously formed concepts will be constructed accordingly again (Erdener, 2009). When viewed from this perspective, daily concepts provide basic aspects necessary for the evolvement of scientific concepts; preliminary learnings constitute the basis of subsequent learnings; and the cognitive structures formed by current knowledge are used in the process of giving meaning to new information.

The cognitive structures which have an important place in the process of learning, remembering and organizing the information are defined by Davidson (1977) as "inter-connected concepts used by the individual to discriminate between the messages received" (Uçak and Güzeldere, 2006). According to Shavelson (1974), cognitive structure is an presumptive structure indicating the organization of concepts in students' long-term memories, and the relationships between them.

The development of the cognitive structure influences the individual's pace of understanding whether the message received is related or not. In addition, the number of categories in the cognitive structure has directly proportional influence on the number of relations between these categories and makes it easier or harder for the individual to perceive the information and to establish a relationship (Uçak and Güzeldere, 2006).

Students with weak cognitive structure have the ability to process weak knowledge and adapt knowledge to new conditions and daily events (Tsai and Huang, 2002). In this respect, an individual's cognitive structures related to concepts regarding a subject area directly or indirectly affect his or her learnings in relation to that subject area.

When studies reported in related literature are examined, it is seen that there are several difficulties experienced in relation to conceptual teaching/learning; that a number of concepts have been conceptualized wrongly or inefficiently; and that this situation raises an important problem (Baysen et al., 2012; Güneş et al., 2010; Duman, 2003; Turan, 2002; Yükselir, 2006).

Duman (2003) points out that certain professional concepts especially related to education are used in a way to cause misconception in related literature not only because of incorrect translations but also because of loading different meanings. When the importance of concepts is examined with respect to scientific thinking, discussion and productivity regarding a certain area, it is seen that learning basic concepts in education as a science in a way to help avoid any misconception is influential on pre-service teacher training and subsequently on teacher quality.

Laska (1984) points out that an important development achieved in terms of instructional theories primarily requires defining basic concepts well. Basic concepts not only constitute the basis of all education-related theories directly or indirectly but serve all the dimensions of education ranging from determining the objectives of education to the evaluation of the teaching-learning process in a formal structure. The quality of this service is thought to have positive or negative influence first on preservice teacher training and then on the quality of education and related activities at schools when the spiral structure of learning is taken into account.

Learning, which is a biological and psychological process, occurs as a result of experiences gained by individuals via their interactions with their environment, while teaching is regarded as an activity of planning and achieving learning (Ertürk, 1986). This activity requires the teacher, the learner and the elements being learned to be interaction with one another. It could be stated that the teacher is effective in the teaching process, in which the field expert (teacher) presents the information to the learner (student) and provides the environment and conditions necessary for learning, while it is both the student and the teacher who are effective in the learning process (Alkan, 1987).

It is more important to identify the misconceptions about basic concepts of teacher training and looking for

Table 1. Information about the students.

Participants*	Gender	Department	Doing preliminary preparation prior to lessons
Sinan	M	Social sciences teaching	Yes
Sevil	F	Social sciences teaching	Yes
Kaan	M	Social sciences teaching	No
Ceren	F	Social sciences teaching	No
Gizem	F	Science teaching	Yes
Burcu	F	Science teaching	Yes
Kerim	M	Science teaching	No
Hakan	M	Science teaching	No

* The names of the participants were coded.

the solutions in order to put away them because prerequisite knowledge and conceptions generates a step for later subjects (Mehmetlioğlu, 2014). In this respect, the purpose of this study was not only to determine the cognitive structures of education faculty students (who have the role of a learner) regarding professional concepts, and to examine their perceptions of the process of learning concepts but also to reveal the perceptions of faculty members (who have the role of a teacher) in relation to teaching professional concepts. In line with these purposes, the following research questions were directed in the study:

(1) What are students' cognitive structures regarding professional concepts?
(2) What are students' views about the process of learning professional concepts?
(3) What are the faculty member's views about the process of teaching professional concepts?

METHODOLOGY

Research design

The study was carried out using the case study design, one of qualitative research methods. Yıldırım and Şimşek (2011) define case study as one which allows not only investigating one or more situations in an in-depth manner but also examining relational factors holistically and which tries to determine the effects of these factors on the related situation or the effects of the latter on the former. In this respect, in the present study, the cognitive structures regarding the professional concepts found in teacher training constitute the situation in question. Therefore, the study aimed to conduct in-depth examination of the views of the faculty member and of the students about the process of teaching and learning the concepts.

Participants

The study was carried out with 69 second grade students attending the departments of Science Teaching and Social Sciences Teaching at a state university located in Eastern Mediterranean Region in Turkey, and with a faculty member giving the course of Introduction to Educational Sciences in both departments.

In the study, the criterion sampling method, one of purposeful sampling methods, was used. According to the criterion taken into account to determine the participants, the students who had similar academic achievement and taken the course of Introduction to Educational Sciences, which introduced professional concepts to them, were included in the research sample, and a faculty member who gave this course in the two departments was asked to take part in the study.

In addition, interviews were conducted only with volunteer students. The faculty member (FM) participating in the study had a Phd degree with a teaching experience of 16 years in the profession. Table 1 presents information about the eight students interviewed in the research process.

When Table 1 is examined, it is seen that the students interviewed in the research process demonstrated an equal distribution in terms of their gender and their department, and that four of them did preliminary preparations before the lessons.

Research instruments and data collection process

According to Schmidt (1997), in order to determine and analyze misconceptions, interviews, multiple-choice tests, open-ended questions, concept maps, word-association tests and a combination of these methods can be used (Selvi and Yakışan, 2004). In this respect, for the first research question directed in the present study, the data were collected using the Word-Association Test, and two semi-structured interview forms were used for the second and third research questions.

The Word-Association Test (WAT) is defined as one of the oldest and most common methods which allows revealing students' cognitive structure and the connections between the concepts in this structure, which helps analyze the information network and which tries to determine whether there are efficient connections between the concepts found in the long-term memory (Bahar and Özatlı, 2003; Cardellini and Bahar, 2000).

In this method, students are asked to write down the concepts they remember in relation to a key concept regarding a certain subject in a certain period of time (appropriate to the students' level). In order to form the word-association test within the scope of the present study, six key words (education, instruction, learning, teaching, curriculum and course curriculum) were selected. In the application carried out with 69 students, each concept and the statement expected to be written down for each concept were to fit one page. Before the application, the students were provided with necessary explanations regarding WAT, and examples of different applications were given. The students were asked to fill in the statement part related to each key concept in a response time of 30 seconds.

Within the scope of the study, interviews were held with four

students from the department of Science Teaching (two female and two male), with four students from the department of Social Science Teaching (four female and four male) and with the faculty member giving the related course. During the interviews held with the students, a semi-structured interview form made up of seven open-ended questions was used. In addition, during the interviews, the focus was on thoughts about learning certain professional concepts, strategies favored in the process of learning these concepts, the problems experienced and related solutions suggested in relation to these problems, the concepts easiest and most difficult to learn, and on the professional benefits of conceptual learning.

As for the interview held with the faculty member, another semi-structured interview form including five open-ended questions was used, and the interview was audio-recorded. During this semi-structured interview, the faculty member was asked to report his views about whether he did any preparation for the course of Introduction to Educational Sciences in relation to teaching professional concepts, which concepts he found important to teach and what way he followed while teaching these concepts.

Data analysis

In order to analyze the data collected with WAT, descriptive analysis was conducted, and the words and statements written as response to the key concepts were examined in detail. First, a table of frequency demonstrating how many times the concepts or words for each key concept were repeated was formed. Based on this table of frequency, concept maps, which are graphical materials schematizing the connections between different concepts and ideas, were formed. While forming the concept maps, the Cut-off Point (COP) technique suggested by Bahar et al. (1999) was used.

According to this technique; five words deficient of the maximum number of words produced for any key concept involved in the WAT is used as cut-off points. The answers above this frequency are written into the first part of the concept network. Then, the cutting point is pulled down at regular intervals and the process continues until all key words appear in the concept network.

Another dimension analyzed in the Word-Association Test was the analysis of the statements written down in relation to each concept. The students were asked to write down a statement regarding each concept. In this respect, the statements written down by the students in the related part of the test were examined with respect to the information and the meanings provided.

According to the statement analysis classifications put forward by Ercan et al. (2010), statements including scientific information (SISI), statements including non-scientific and superficial information (SINSI) and statements including misconceptions (SIM) were analyzed. For the analysis of the interview data, the inductive content analysis method (Patton, 2002) was used.

In line with the strategies suggested regarding the credibility and transferability of the study (LeCompte and Goetz de, 1982; Yıldırım and Şimşek, 2011; Guba and Lincoln, 1982), the research findings were presented without doing any related interpretation, and the themes formed via the interviews and the statement categories formed via the Word-Association Test were supported with direct quotations. For triangulation, another precaution to be taken to increase credibility, different methods and sources were used to cross-check the information and results obtained (Johnson and Christensen, 2004; Patton, 2002).

In this respect, in the study, method and data triangulation was done, and the consistency of the data collected from the students and the faculty member via the Word-Association Test and Interviews was examined and compared. In addition, for the credibility of the study, another researcher was asked for cooperation and to provide related feedback and to do the necessary corrections throughout the whole process of preparing

Table 2. Frequencies of the words produced in relation to the key concepts.

Key concepts	Frequency (f)
Education	101
Teaching	74
Course curriculum	63
Curriculum	51
Learning	43
Instruction	27
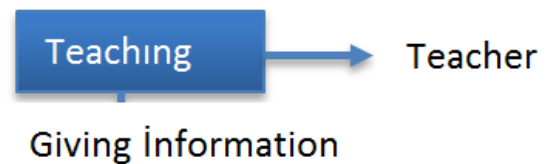
Figure 1. Concept map formed for the cut-off point of 25 and higher.

the data collection tools and interpreting and reporting the findings (Holloway and Wheeler, 1996; Houser, 2015; Streubert and Carpenter, 2011).

FINDINGS AND DISCUSSION

In line with the first sub-purpose of the study, the word-association test was used to let the students write down the words regarding the professional concepts and the statements related to these concepts. Table 2 presents the frequencies of the words produced for each concept.

When Table 2 is examined, it is seen that the highest number of associated words belonged to the concept of "education" and that the lowest number of associated words belonged to "instruction". In order to reveal the students' cognitive structures regarding the key concepts, the words associated with the concepts were examined in detail. Figure 1 demonstrates the concept maps obtained as a result of the analysis taking the cut-off points into consideration.

When Figure 1 is examined, it is seen that the concept with the highest frequency for the cut-off point of 25 and higher was teaching. The concepts which were associated with teaching and which had a frequency value higher than 25 were "teacher" and "giving information".

When Figure 2 is examined, it is seen that for the cut-off point between 20 to 24, there was an increase both in the number of key concepts and in the words associated with the key concepts. It was found that the students
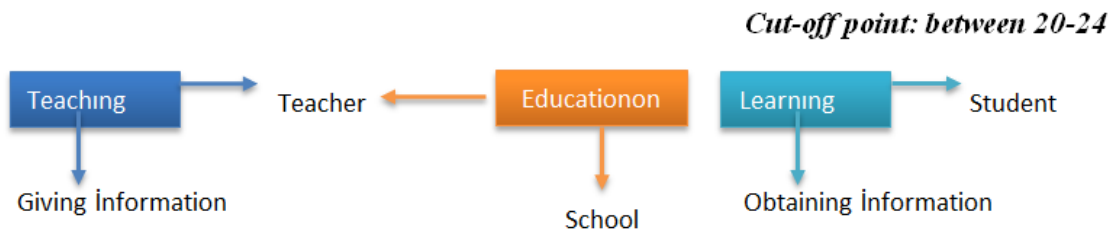
Figure 2. Concept map formed for the cut-off point between 20-24.
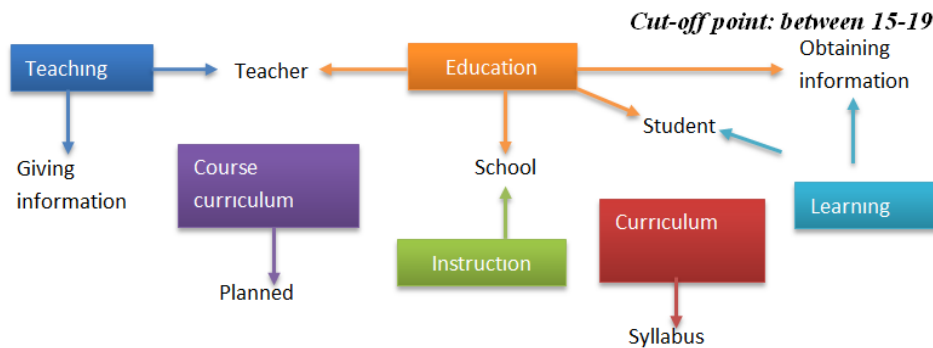
Figure 3. Concept map formed for the cut-off point between 15-19.

associated "education" with the concepts of school and teacher and that they associated "learning" with the concepts of student and obtaining information.

When Figure 3 is examined, it is seen that the words associated with "education" for the cut-off point between 15 to 19 were teacher, school, student and obtaining information and that the key concepts were "instruction, curriculum and course curriculum". When Figure 4 is examined, it is seen that all the six key points in the study were revealed for the cut-off point between 10 to 14, and that a number of words were associated with these key concepts. Considering the range in question (10 to 14), it was found that the concept of "teaching" was associated with the concepts of *giving information, teacher* and *student*; the concept of "education" with *process, student, teacher, school* and *obtaining information*; the concept of "learning" with *obtaining information* and *student; the concept of* "course curriculum" with *teacher, student, school, content* and *planned*; the concept of "instruction" with *school* and *content*; and the concept of "curriculum" with *educational environment, syllabus, comprehensive and regulatory*.

Table 3 presents the frequencies of the statements found in the categories as a result of the analyses of the statements. When Table 3 is examined, it is seen that the students made a sentence for all categories of statements and the key concept with the highest

frequency was "education". When the key concepts were examined with respect to the statement categories, it was seen that the statements which mostly included scientific information, non-scientific superficial information and misconception belonged to the concept of education; that the highest number of statements belonged to the concepts of education and learning; and that the lowest number of statements regarding the concepts belonged to instruction, teaching and course curriculum. Sample statements related to the categories were as follows:

It is a process of developing permanent good-quality intended behaviors in the process of individuals' in-school and out-of-school lives (Education, SISI)

The teacher's job is to teach beneficial information to children (Teaching, SINSI)

Education is given during lessons at school by the teacher via life experience (Education, SIM)
It is me who makes decisions related to education (Education, irrelevant)

Views of the faculty member and students about learning professional concepts

During the interviews held with the students in relation to
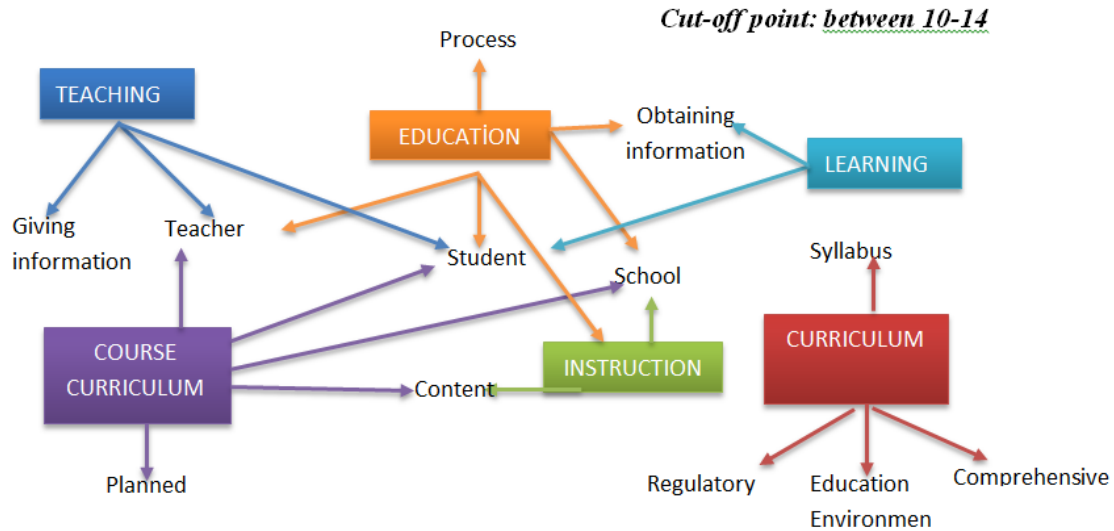
Figure 4. Concept map formed for the cut-off point between 10-14.

Table 3. Categories of statements regarding the professional concepts and the related frequencies.

Key words	SISI*	SINSI*	SIM*	Irrelevant	Total	Blank
Education	26	20	9	3	58	11
Curriculum	22	6	5	1	34	35
Learning	21	2	5	3	31	38
Course curriculum	19	2	4	-	25	44
Instruction	13	3	7	1	24	45
Teaching	13	6	5	1	25	44

*SISI: Statements including scientific information; SINSI: Statements including non-scientific and superficial information; SIM: Statements including misconceptions

learning the concepts regarding the profession of teaching, four of the eight students pointed out that it was necessary to learn these concepts. Table 4 presents the categories, the sub-categories, the codes and the frequencies revealed depending on the participants' views.

When the categories in Table 4 are examined, it is seen that the participants reported their views about learning professional concepts under the following four categories: contribution to professional competency, supportive implementations, complicating factors and suggestions for learning. Of all the participants reporting their views in relation to the category of contribution to professional competency, six of them emphasized contribution to professional knowledge, while three of them put emphasis on contribution to the dimension of planning instruction. Burcu, one of the participants, mentioned contribution to professional knowledge, said:

"If you learn these concepts, you will form the basis of professional knowledge as a teacher. You will consider certain factors in teaching and learning, and you will become aware of which factors to take into account. In

this respect, I think it is really important" (Burcu, pp. 2).

Another participant, Kaan, who mentioned the dimension of planning instruction within the scope of the same category, said:

"It is primarily essential for a teacher to learn these concepts because a teacher is supposed to conduct a course in line with a certain syllabus Planning instruction is possible especially when the meanings conveyed by concepts are understood well" (Kaan, pp.2).

When the faculty member's views about learning professional concepts were examined, it was found that he made explanations supporting the students' views. In general, the faculty member stated that it was important and necessary to learn professional concepts and that these concepts constitute the basis of having the necessary professional knowledge and keeping up with the field-related developments, said:

"In the end, all the students I teach in the department will become a teacher in future. Thus, they first have to learn correct use of the concepts required by their profession…

Table 4. The results of analysis relation to learning professional concepts.

Categories	Codes	Participants	Frequency
Contribution to Professional Competency	Professional knowledge	Kerim, Hakan, Gizem, Burcu, Sinan, FM	6
	Planning instruction	Ceren, Gizem, Kaan	3
	Achievement of academic development	Sevil, FM	2
Supportive implementations	Use of learning strategies	Ceren, Kerim, Hakan, Sevil, Kaan, Burcu	6
	Use of different sources of information	Ceren, Sevil, Kaan, Sinan	4
	Associating with daily life	FM	1
	Use of questions at cognitive skill level	FM	1
	Considering individual differences	FM	1
Complicating factors	**Student-based factors**		
	Misconceptions	Kerim, Hakan, Burcu	3
	Giving importance to the course	Hakan, FM	2
	Lack of preliminary knowledge	Sevil	1
	Lack of motivation	FM	1
	Factors based on the faculty member		
	Use of a single teaching method	Kerim, Sevil, Burcu	3
	Giving abstract examples	Sevil	1
	Use of inefficient examples	Sevil	1
Suggestions for learning	Giving examples related to concepts	Ceren, Kerim, Gizem, Sevil, Kaan, Sinan, FM	7
	Use of different teaching methods and techniques	Kerim, Hakan, Burcu, FM	4
	Use of visual materials	Hakan, Sinan	2
	Meeting the course requirements	Kaan, Burcu	2
	Presenting clear and comprehensible information	Sevil	1
	Supporting teaching with different information sources	Burcu	1
	Associating with thinking skills	Hakan	1

because good teachers are those who have enough professional knowledge and who can follow the related professional developments to improve themselves in their job. In order for teachers to keep their professional knowledge up-to-date, they need to understand the related essential concepts well" (FM, pp.2).

Regarding the category of supportive implementations, it is seen that the students mostly used learning strategies (f:6), and benefitted from different sources of information (f:4). Kaan, one of the participants who stated that he used learning strategies, said:

"After the lesson, I do preparation by studying the subjects again" (Kaan, pp. 3).

While another participant, Sevil, reported her views said:

"For example, while studying myself on the definition of

education, I note down short definitive statements" (Sevil, pp.4).

Kaan, who stated that he made use of different sources of information to support learning, said:

"I prepare for these concepts via the course books of educational sciences and curriculum development and with the help of online videos related to the Government Staff Placement Exam" (Kaan, pp.4).

As a result of the interview held with the faculty member, who constitutes an important part of the process of conceptual learning, it was seen that the faculty member tried to motivate the students by focusing on the place and importance of the subjects in daily life and used sample events; that in relation to the dimension of assessment, he paid special attention to preparing good-

quality questions and favored questions mostly at cognitive skill level. In this respect, the faculty member reported his views as follows:

"I try to motivate my students with the help of sample cases by explaining how they will make use of them in their lives. In general, honestly, I cannot say that I use the holistic approach to assessment I really think a lot about the quality of the questions. Rather than just using questions to measure the knowledge directly, I mostly try to prepare questions that will let students analyze a sample case and then find a related answer as a result of this analysis"(FM, pp.4)

Regarding the category of complicating factors, the participants' views were classified under two sub-categories: "student-based factors" and "factors based on the faculty member". For the sub-category of student-based factors, the students mostly stated that they had misconceptions (f:3), while the faculty member said the students did not give the necessary importance to the lessons. Burcu, one of the students who stated that she had misconception, said:

"In fact, those concepts were a bit … I mean, for example, instruction, what I know about instruction was a lot different from the one in the course book, and this was also true for learning. I was really surprised to see that what I had known about it was wrong" (Burcu, pp.3)

The faculty member, who stated that the students did not give enough importance to the course said:

"(…) to tell the truth, it seems to me that students think the course is unnecessary, so I don't think they pay much attention to the course. But that's just my own belief" (FM, pp. 5).

In relation to the sub-category of the factors based on the faculty member, the problem most frequently reported was the use of a single teaching method (f:3). Regarding this problem, one of the participants, Sevil, said:

"Generally, our lessons are taught in the same way all the time. For this reason, we just develop our abstract knowledge, and when you cannot concretize your knowledge, it does not become permanent in your mind" (Sevil, pp. 4)

Regarding the category of suggestions for learning professional concepts, it was seen that the participants mostly reported views about increasing the use of examples related to the concepts (f:7). In relation to this, Gizem, Kerim and Ceren said:

"(…) giving examples from daily life increase permanency of what you have learned in class (Gizem, pp. 4)"; "(…) it

would be better if examples from real life or from our own lives are provided (Kerim, pp. 4)"; "I generally understand definitions of concepts better via examples. Thus, I think frequent use of such examples in class would be of our benefit. Teaching concepts should not just involve writing down the definition of the concept. We can learn more easily if related examples are given (Ceren, pp. 6)". As for the faculty member, he reported his views about the subject as follows: *"Sample events should be used more. Students could bring sample events into class as well. They can first discuss the correctness of those sample events together, and then, the lesson should be taught with the help of a correct event" (FM, pp. 5).*

Another suggestion put forward by the participants in relation to conceptual learning was related to the use of different teaching methods and techniques (f:4). Regarding this subject, one of the participants, Burcu, said:

"As concepts are taught via presentations, students easily forget what they have learned in class. If a concept is first presented via a story or novel or a related discovery or invention, it will be more permanent in students' minds. For example, I myself don't know the real definitions of these concepts at the moment. Thus, I don't think students remember these concepts after a while if they learn these concepts in that way" (Burcu, pp.6).

CONCLUSION AND IMPLICATIONS

When the concept maps obtained in the study were examined, it was seen that the words produced for all the professional concepts except for curriculum were in association with each other. When the concepts were examined with respect to the words, it was found that the concept of education was associated with the words of "teacher, school, students, *instruction*, obtaining information and process"; the concept of course curriculum with the words of "planned, teacher, student, school and content"; the concept of teaching with the words of "giving information, teacher and student"; the concept of learning with the words of "obtaining information and student"; the concept of instruction with the words of "school and content"; and that the concept of curriculum was associated with the words of "syllabus, comprehensive, regulatory and educational environment".

Bahar et al. (2006) point out that the number and quality of words associated with a concept help determine whether the concept has been understood or not. In this respect, considering the numbers and the qualities of the words produced as response to the key concepts in the present study, it could be stated that the students defined most of the concepts correctly; that the concept of course curriculum was the one the students

learned best among all other concepts as the highest number of correct words belonged to that concept.

In addition, this finding is also supported with the fact that in the related statement analysis, the concept of course curriculum had the lowest frequency of statement including misconceptions (f:4). Another concept was education which was thought to involve misconception though almost the same number of words were produced for this concept as for the concept of course curriculum.

In addition, based on the fact that the students associated the concept of education mostly with the words of "school" and "teacher" (COP: 20-24), it could be stated that the students considered education to an action carried out only by the teacher at school. according to the analysis of the related statements, the fact that the statements which included the highest number of misconceptions were related to the concept of education and that the students defined education as "something *taken at school via experience with the help of the teacher*" could be regarded as an indicator of this misconception. When the students' responses were examined in terms of the concept of teaching, it was seen that the first concept of teaching in the concept map (COP: 25 and higher) was associated with the words of "teacher" and "giving information", which demonstrates that the students mostly defined this concept correctly.

According to Uçak and Güzeldere (2006), the number of categories in the cognitive structure has directly proportional influence on the number of relationships between these categories and makes it easy or difficult for the individual to understand the information In literature, the concept of teaching is defined by Ertürk (1986) as an activity of guiding learning, while Glasser (1992) refers to it as a process of giving information to people who are willing to increase the quality of life by being a model. Therefore, the related findings obtained in the present study are consistent with those reported in related literature. When the analysis of the related statement is examined, the students could be said to have difficulty making statements including scientific information though they associated the concept with correct words as the concept of teaching had the lowest frequency in terms of the category of statements including scientific information (f:13).

The concept of learning which was found to have the same cut-off point with the concept of education in the concept map (COP: 20-24) was associated by the students only with the words of "obtaining information" and "student". In related literature, learning is defined as "a product of life experience and relatively permanent behavioral change" (Gagne and Driscol, 1988) and as "the process of changing one's old behaviors or developing new behaviors as a result of one's interaction with the environment or via his or her life experiences depending on his or her level of maturation" (Binbaşıoğlu, 1983).

Considering the two definitions, students are expected to associate the concept of learning with the words of experience, permanent behavior or process. On the other hand, based on associating the concept only with obtaining information and with student, it could be stated that students have superficial knowledge about the concept.

In the concept map, the cut-off point was between 15 to 19, and in this range, course curriculum was associated with "planned"; instruction with "school"; and curriculum was associated with "syllabus". In the last cut-off point (COP: 10-14), it is seen that the number of associated words increased (instruction: *school, content and education;* curriculum: *syllabus, comprehensive, educational environment, regulatory*) and all the concept except for curriculum had at least one common word shared with the other concepts.

In related literature, instruction is defined as "the process of doing the necessary preparations for the teaching-learning process appropriate to the course curriculum and conducting such a process effectively enough to end up with the desired product and with all the expected behaviors" (Özçelik, 2014) and as "applications carried out in a purposeful, planned, regular and controlled manner within the framework of a previously prepared curriculum in an educational institution" (Güneş, 2014).

In this respect, depending on the fact that the number of the words the students associated with the concept of instruction was limited and that this concept had the highest frequency of statements including misconception followed by the concept of education, it could be stated that the concept in question was not understood well.

The fact that the number of the words associated with the concept of curriculum, one of the most comprehensive concepts, and that this concept did not have any common word shared with the other concepts was the most striking finding obtained in the study. In related literature, the concept of curriculum is defined as "the whole of the life experiences gained by students under the guidance of their teachers" (Caswell and Campbell, 1935; Demirel, 2013), while Doll (1986) regards it as both process and content which allow changing students' values, attitudes and behaviors and developing their skills, knowledge and understanding.

In this respect, the response words associated by the students explained the concept of curriculum correctly but not efficiently. In addition, it could be stated that the concept in question was not understood well since the concept with its really broad meaning did not have any common word shared with the other key concepts (Uçak and Güzeldere, 2006).

According to the results obtained in relation to the second sub-purpose of the study, the participants stated that learning professional concepts contributed to professional competency in terms of professional knowledge, instructional planning and academic development. Laska (1984) points out that in order to

achieve an important development in instructional theories, basic concepts should primarily be defined well. These concepts are included in the content of the course of "Introduction to Educational Sciences" given to freshman students in all the departments of education faculties.

In relation to the course of Introduction to Educational Sciences, Erginer (2006) states that "thanks to this course, students will be able to adapt themselves to other profession-related courses in upper classes". Similarly, the views of the students and of the faculty member are supported by Erdem (2013), who consider introductory courses to be among the primary courses that allow achieving the outcomes in a specific field. In addition, the fact that professional concepts learned within the scope of the course in question constitute the basis of subsequent learning also supports the related views of the students and the faculty member.

Regarding the theme of supportive implementations, the students' views were found to be related to use of different sources of information and learning strategies. As for the faculty members' views, their views were about association with daily life, use of problems related to cognitive skill level and considering individual differences. In related literature, different methods and strategies are suggested regarding how to sequence and present the content elements of the concept and how to teach the concepts. As a strategy for concept teaching, Merrill and Tennyson (1977) suggest a deductive approach (Van Cleaf, 1991).

Tennyson and Cocchierella (1986) point out that concept teaching involves three phases. Martorella (1998) claims that concept analysis should be conducted for concept teaching. Malatyalı and Yılmaz (2010) state that importance should be given not only to conceptual learning but to concept teaching as well for meaningful and permanent learning and that different teaching methods should be applied to allow students to learn the meanings of concepts without being dependent on a single teaching method.

Malatyalı and Yılmaz (2010) who suggests use of a discovery-involved teaching strategy in learning environments which include students with higher level of thinking skills, point out that this strategy will allow students to discover conceptual learning via their own experiences, their background knowledge, their observations and their interactions with their environment. Ülgen (2001) who claims that conceptual learning involves two elements such as product and process, states that in relation to learning as a product, individuals develop observable behaviors regarding the concept and that these behaviors include expressing their knowledge about their concept, defining the concept together with its characteristics, stating the characteristics of the concept by comparing it with other similar concepts, defining the new concept by comparing it with a similar concept based on their background knowledge

about that concept, and making a related classification in line with appropriate criteria.

In this respect, the views reported in related literature in relation to the applications supporting concept teaching/learning could be said to be consistent with the views of the students and of the faculty member. Regarding the theme of complicating factors, the student-based factors were reported to include existence of misconceptions, lack of importance to be given to the course, lack of background knowledge and lack of motivation. Misconception is defined as knowledge that hinders learning or teaching the scientifically proven concepts (Çakır and Yürük, 1999), and in related literature, it is asserted that student-oriented teaching approaches (concept maps, analogy, metaphor and so on) should be adopted and applied to overcome misconceptions (Riche, 2000).

Another view reported in relation to the sub-category of student-based factors was related to lack of background knowledge and lack of importance to be given to the course. According to the National Research Council, students' attitudes towards the course and the subject determine their approaches to the course, their levels of knowledge about the subject, their performances, their desire to obtain information as well as their interests (National Research Council, 1996).

In this respect, as mentioned by Ekici (2008), preservice teachers, who have high levels of attitudes towards profession-related courses, could be said to be more inclined to and successful in learning. As for the category of the factors based on the faculty member, it included use of a single teaching method, use of abstract examples, and inefficient use of examples. As mentioned earlier, in the process of conceptual teaching, use of more than one student-centered teaching method rather than a single type of teaching method is suggested. Besides this, when the related literature is examined, it is seen that in conceptual teaching, use of visual materials to present distinct characteristics, definitions and examples related to the concept is quite effective in the teaching-learning process (Erden and Akman, 1997; Kaptan, 1998; Malatyalı and Yılmaz, 2010).

Consequently, in the study, it was found that the students had the least misconception about course curriculum and the most misconception and superficial knowledge about the concept of education. In addition, it was revealed that the teaching-learning process carried out in relation to professional concepts contributed to professional competency and those factors like use of learning strategies and different sources of information support the process in question.

On the other hand, it was found that the students' misconceptions and the faculty member's use of a single teaching method made the teaching-learning process difficult. Moreover, it was concluded that improvement of the process requires giving examples related to concepts and diversifying various teaching methods and

techniques.

In this respect, in relation to teaching professional concepts in the process of teacher training, first of all, individuals' misconceptions could be determined by revealing their background knowledge about concepts; learning strategies could be applied considering individual differences; different sources of information could be used; and the teaching process could be carried out in a way to take students' needs into account.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Full Length Research Paper

Investigating female pre-service preschool teachers' attitudes towards sport

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The purpose of this study was to investigate female pre-service preschool teachers' attitudes towards sport in relation to the variables of grade level, the state of having done sport in the past, the reason for not doing sport in the past, the state of doing sport regularly, the level of interest in sport and the existence of a family member doing sport. Participants included 383 pre-service preschool teachers attending Ahmet Keleşoğlu Education Faculty of Necmettin Erbakan University in the 2015 to 2016 academic year. In determining participants' attitudes towards sport, "The Scale of Attitudes towards Sport" was used. In the statistical analysis of the collected data, frequency analysis, Kruskal Wallis H test and Mann Whitney U test in SPSS 22.0 program were used. At the end of the study, it was found that female pre-service preschool teachers' levels of psychosocial development, physical development and total attitude levels are high yet their mental development attitude level is medium. When the data were evaluated on the basis of the demographic features, it was found that their attitudes towards sport vary significantly depending on the variables of the state of having done sport in the past and the state of doing sport regularly ($p<0.05$). However, their attitudes towards sport do not vary significantly depending on the variables of grade level, the reason for not having done sport in the past, the level of interest in sport and the existence of a family member doing sport ($p>0.05$). As a result, it can be argued that having done sport in the past and doing sport regularly at present positively affect the attitudes towards sport.

Key words: Preschool teaching, sport, attitude.

INTRODUCTION

A whole body of conscious movements referring to physical, mental and spiritual phenomena, carried out around certain rules, requiring a spirit of struggle, and done for the sake of having fun, competing, racing and achieving a healthy life is defined as "sport" (Ramazanoğlu et al., 2005: 155). As can be understood

from this definition, sport activities are constituted by physical activities in which motivation to win is in the foreground. In addition to this, sport is a phenomenon requiring physical, technical and mental efforts creating a sense of aesthetic in spectators and integrated with disciplines such as psychology, bio-mechanic and

physiology (Çoban and Ünveren, 2007).

Participation in sporting events has a great importance for they affect human life in many aspects positively (Güner, 2015; Şahan, 2008). At the forefront of the benefits brought about by sport to human life are physical. It is known that participation in sport activities has improved joint, muscular and connective tissues as well as increasing the physical condition of the person (Açak, 2006).

In the literature, as well as physical and conditional benefits of sport, its psychological and social benefits have been emphasized, and its protective role in increasing the general health level and preventing some metabolic diseases have been pointed out. The experimental and descriptive findings in the literature demonstrate the physical (Karadağ, 2012; Ağaoğlu et al., 2008), psychological (Armstrong and Oomen-Early, 2009; Dunn et al., 2005) and social (Özkan, 2011; Nebioğlu, 2006) benefits of sport and support the idea that sport has a protective role in enhancing the general health status and preventing some diseases (Gökhan et al., 2011; Tsai et al., 2004; Sigal et al., 2007; Snowling and Hopkins, 2006).

The reactions of people towards objects and phenomena in their environments are expressed as "attitude". As can be understood from this definition, attitudes are types of behaviors exhibited by people towards events and situations faced by them. However, people's attitudes are not limited to events or phenomena. As such, people can demonstrate attitudes towards a design, an abstract phenomenon, an object and a person in their daily lives. Attitudes possessed by people are shaped by the features of the geographical region they are living in, their knowledge level, socialization processes and life experiences (İnceoğlu, 2010).

Attitudes are made out of three elements: mental, affective and behavioral. These elements constituting attitudes are in interaction with each other, and there is a harmony between them (Özkan, 2011; İnceoğlu, 2010). The process of perceiving a state or a concept by an individual is defined as the mental element. Emotions emerging when people are confronted with states or events make up the affective element. Conversion of evaluations made for the stimulus involved in encountered states or events into behaviors makes up the behavioral element (Karadağ, 2012).

In this regard, the only element of the attitude that can be observed is the behavioral element. People create their perception of any object on the basis of their emotions, beliefs and value judgments. Also, reactions towards any object remain at a certain level (Üresin, 2012). As there is a connection between attitudes and behaviors exhibited by people, knowing the direction of an individual's interest in the stimulus can help predict the behavior to be displayed. This is of great importance because when the connection between the attitude and behavior is well known, proper training can be given to

individuals for their future career and the content of such training can be designed to improve individuals' attitudes (Üstüner, 2006).

Given the aforementioned above, it is clear that attitudes directly or indirectly affect behaviors of people. In this connection, people's attitudes towards sport can have important influences on their motivation to do sport and sport-related behaviors. As known well, the gender within the social structure affects attitudes towards sport (Chung and Phillips, 2002). The research, in this regard, has revealed that when compared to males, females' attitudes towards sport are more negative (Kangalgil et al., 2006; Yağcı, 2012). For example, Swanepoel et al. (2015) found male students in universities to be more inclined to sport compared to their female peers. Indeed, the results of Tereza and Dosil (2015) study showed that the attitudes towards sport were more positive in younger male individuals who regularly engaged in sports and whose parents also engaged in physical activities. Therefore, in order to improve females' orientation and the factors affecting their attitudes towards sport should be well explored.

In this respect, the current study aims to investigate female pre-service preschool teachers' attitudes toward sport in relation to the variables of grade level, the state of having done sport in the past, the reason for not doing sport in the past, the state of doing sport regularly, the level of interest in sport and the existence of a family member doing sport.

Specifically, the following six questions guided the study:

1. Does the variable of grade level affect female pre-service preschool teachers' attitudes towards sport?
2. Does the variable of having done sport in the past affect female pre-service preschool teachers' attitudes towards sport?
3. Does the variable of not doing sport in the past affect female pre-service preschool teachers' attitudes towards sport?
4. Does the variable of doing sport regularly affect female pre-service preschool teachers' attitudes towards sport?
5. Does the variable of interest in sport affect female pre-service preschool teachers' attitudes towards sport?
6. Does the variable of a family member doing sport affect female pre-service preschool teachers' attitudes towards sport?

METHODOLOGY

Research model

In the current study, one of the observation-based research models frequently used in the fields of education and sports, the survey research method was used. The survey method is used by researchers who want to find answers to their questions and test whether their research hypotheses are correct or not. To this end, researchers develop some hypotheses and use questionnaires or scales in order to test them. The survey method also allows the

Table 1. Demographic features of the participants.

Variable	Sub-variables*	N	%
Grade level	1st year	76	19.8
	2nd year	80	20.9
	3rd year	143	37.3
	4th year	84	21.9
The state of having done sport in the past	Never	89	23.2
	Sometimes	269	70.2
	Always	25	6.5
The reason for not doing sport in the past	My family did not let	15	16.9
	I did not have time	63	70.8
	Economic reasons	11	12.4
The state of doing sport regularly	1-3 days a week	176	46.0
	4-6 days a week	27	7.0
	Everyday	12	3.1
	I do not do any sport	168	43.9
Interest in sport	Through newspapers	19	5.0
	Through social media	216	56.4
	Through television	89	23.2
	Through sport contests	26	6.8
	I am not interested	33	8.6
A family member doing sport	Father	19	5.0
	Mother	22	5.7
	Sibling	138	36.0
	No one	204	53.3

*The participants chose the most suitable one from the choices.

investigation of the target features of large samples (such as age, gender, marital status, etc.), thus, it is also known as descriptive research (Can, 2014).

Study group

The study was conducted with 383 female pre-service preschool teachers attending the Department of Preschool Education at Ahmet Keleşoğlu Education Faculty of Necmettin Erbakan University in the 2015 to 2016 academic year.

Some demographic features of the participants are shown in Table 1. According to Table 1, most participants were from the third grade level (37.3%), do sport sometimes at present (70.2%), did not have time to do sport in the past (70.8%), do sport 1 to 3 days a week (46%), developed interest in sport through social media (56.4%) and generally do not have any family member doing sport (53.3%).

Data collection

In the collection of the data, "The Scale of Attitudes towards Sport" (Appendix A) developed by the researcher on the basis of a literature review was used. In addition to this, for the development of the scale, the items of Koçak (2014) were adapted. There are

totally 27 items in the scale, and it is formed through a five-point Likert structure. The response alternatives to the scale items are strongly agree (5), agree (4), undecided (3), disagree (2) and strongly disagree (1). The scale has three sub-dimensions, and the high scores obtained from a specific sub-dimension indicate that a participant's attitude regarding the corresponding sub-dimension is high. The sub-dimensions of the scale and the items belonging to them are as follows:

(1) Psychosocial development items: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, and 15.
(2) Physical development items: 16, 17, 18, 19, 20, 21, and 22.
(3) Mental development items: 23, 24, 25, 26, and 27.

The results related to the reliability of the scale are shown in Table 2. According to Table 2, the reliability of the whole scale (0.904) as well as the reliability for each sub-dimension was found to be high (0.860 for psychosocial development, 0.789 for physical development, 0.837 for mental development).

Statistical analyses

In the analysis of the collected data, SPSS 22 program package was used. As the data regarding the scores obtained from each

Table 2. The results of the reliability analysis of the scale.

Sub-dimensions	The number of items	Cronbach's alpha
Psychosocial development	15	0.860
Physical development	7	0.789
Mental development	5	0.837
Total	27	0.904

Table 3. Descriptive statistics related to the participants' attitudes towards sport.

Sub-dimensions	N	X	Ss
Psychosocial development	383	4.22	0.461
Physical development	383	4.56	0.442
Mental development	383	3.94	0.701
Total	383	4.25	0.421

sub-dimension of "The Scale of Attitudes towards Sport" and the whole scale did not exhibit a normal distribution, Kruskal Wallis H test, one of the non-parametric tests, was used to compare the sub-dimensions according to the study variables. In the case of a difference between groups found as a result of the analysis, Mann Whitney U test (as a post hoc test) was used to determine between which groups the differences existed.

FINDINGS

Here, research findings are presented. Table 3 shows descriptive statistics related to the participants' attitudes towards sport.

When Table 3 is examined, it is seen that the participants' psychosocial development, physical development and total attitude levels are high while their mental development attitude level is over medium.

Table 4 compares the participants' attitudes towards sport depending on the grade level variable. When Table 4 is examined, it is seen that the participants' psychosocial, physical and mental development and total attitude levels do not vary significantly depending on the grade level variable (p>0,05). Table 5 compares the participants' attitudes towards sport depending on their state of having done sport in the past.

When Table 5 is examined, it is seen that while the participants' physical development attitude levels do not vary significantly depending on their state of having done sport in the past (p>0.05), their psychosocial development, mental development and total attitude levels vary significantly (p<0.05). The significant difference found at the levels of psychosocial development and total attitude is because the attitude level of the participants having always done sport is higher than those of the participants having sometimes done sport or having never done sport. The significant difference found at the mental development attitude level

is because the attitude levels of the participants having always done sport and having sometimes done sport are higher than that of the participants having never done sport.

Table 6 compares the participants' attitudes towards sport depending on their reasons for not having done sport in the past. When Table 6 is examined, it is seen that the participants' psychosocial development, physical development, mental development and total attitude levels do not vary significantly depending on their reasons for not having done sport in the past (p>0.05).

Table 7 compares the participants' attitudes towards sport depending on their state of doing sport regularly. When Table 7 is examined, it is seen that while the participants' physical development attitude levels do not vary significantly depending on their state of doing sport regularly (p>0.05), their psychosocial development, mental development and total attitude levels vary significantly depending on their state of doing sport regularly (p<0.05). The significant difference found at the levels of psychosocial development and total attitude is because of the difference between the attitudes levels of the participants doing sports 1 to 3 days a week and every day and that of the participants not doing any sports. The significant difference seen at the mental development attitude level is because the attitude level of the participants doing sports 1 to 3 days a week is higher than that of the participants not doing any sports.

Table 8 compares the participants' attitudes towards sport depending on their interest in sport. As shown in Table 8, the participants' psychosocial development, physical development, mental development and total attitude levels do not vary significantly depending on their interest in sport (p>0.05).

Table 9 compares the participants' attitudes towards sport depending on the existence of a family member doing sport.

Table 4. Comparison of participants' attitudes towards sport depending on grade level.

Sub-dimensions	Grade level	N	X	Ss	Mean rank	χ^2	p
Psychosocial development	1st year	76	4.17	0.487	182.41		
	2nd year	80	4.25	0.432	197.56	0.910	0.823
	3rd year	143	4.23	0.457	195.09		
	4th year	84	4.22	0.477	190.11		
Physical development	1st year	76	4.48	0.521	180.61		
	2nd year	80	4.52	0.485	186.09	1.717	0.633
	3rd year	143	4.60	0.377	197.84		
	4th year	84	4.59	0.419	198.00		
Mental development	1st year	76	3.96	0.767	198.78		
	2nd year	80	3.94	0.704	192.93	2.330	0.507
	3rd year	143	3.97	0.677	197.15		
	4th year	84	3.86	0.682	176.22		
Total	1st year	76	4.21	0.430	181.66		
	2nd year	80	4.26	0.428	197.03	1.169	0.760
	3rd year	143	4.27	0.408	196.70		
	4th year	84	4.25	0.431	188.56		

Table 5. Comparison of attitudes towards sport depending on the state of having done sport in the past.

Sub-dimensions	State of having done sport in the past	N	X	Ss	Mean rank	χ^2	p	Between-groups difference
Psychosocial development	Never	89	4.15	0.449	173.16			
	Sometimes	269	4.22	0.464	193.02	9.043	0.011	1<3, 2<3
	Always	25	4.46	0.409	248.10			
Physical development	Never	89	4.48	0.545	180.71			
	Sometimes	269	4.58	0.401	194.56	1.427	0.490	-
	Always	25	4.59	0.438	204.60			
Mental development	Never	89	3.78	0.727	166.66			
	Sometimes	269	3.97	0.697	197.02	7.970	0.019	1<2, 1<3
	Always	25	4.17	0.556	228.20			
Total	Never	89	4.16	0.429	170.34			
	Sometimes	269	4.27	0.416	194.67	8.340	0.015	1<3, 2<3
	Always	25	4.43	0.384	240.34			

When Table 9 is examined, it is seen that the participants' psychosocial development, physical development, mental development and total attitude levels do not vary significantly depending on the existence of a family member doing sport (p>0.05).

DISCUSSION

In this study, it was found that female pre-service preschool teachers' attitudes towards sport do not vary significantly depending on their grade level. This might be because at all the grades of their undergraduate education, they are offered similar sports activities and facilities, their expectations from sport might be identical and they may have similar free time to allocate sport. In a similar study conducted by Aydın (2013), it was reported that university students' attitudes towards physical education and sports are positive in general.

The findings reported in the literature indicate that most

Table 6. Comparison of attitudes towards sport depending on the reason for not having done sport in the past.

Sub-dimensions	The reason for not having done sport in the past	N	X	Ss	Mean rank	χ^2	p
Psychosocial development	My family did not let	15	4.22	0.497	49.33		
	I did not have time	63	4.14	0.460	44.83	0.832	0.660
	Economic reasons	11	4.06	0.309	40.05		
Physical development	My family did not let	15	4.51	0.610	48.47		
	I did not have time	63	4.46	0.558	44.03	0.377	0.828
	Economic reasons	11	4.56	0.386	45.82		
Mental development	My family did not let	15	3.84	0.596	47.17		
	I did not have time	63	3.78	0.775	45.25	0.436	0.804
	Economic reasons	11	3.69	0.641	40.59		
Total	My family did not let	15	4.22	0.474	50.47		
	I did not have time	63	4.16	0.444	44.25	0.892	0.640
	Economic reasons	11	4.11	0.277	41.82		

Table 7. Comparison of attitudes towards sport depending on the state of doing sport regularly.

Sub-dimensions	State of doing sport regularly	N	X	Ss	Mean rank	χ^2	p	Between-groups difference
Psychosocial development	1-3 days a week	176	4.29	0.464	210.03			
	4-6 days a week	27	4.22	0.512	191.00	13.940	0.003	1>4, 3>4
	Everyday	12	4.43	0.398	241.83			
	Never	168	4.13	0.441	169.72			
Physical development	1-3 days a week	176	4.62	0.405	207.34			
	4-6 days a week	27	4.47	0.441	167.30	7.267	0.064	-
	Everyday	12	4.62	0.382	202.46			
	Never	168	4.50	0.475	179.15			
Mental development	1-3 days a week	176	4.04	0.686	207.57			
	4-6 days a week	27	3.83	0.634	172.65	9.424	0.024	1>4
	Everyday	12	4.20	0.734	231.25			
	Never	168	3.84	0.711	175.99			
Total	1-3 days a week	176	4.32	0.416	211.63			
	4-6 days a week	27	4.21	0.439	178.26	14.342	0.002	1>4, 3>4
	Everyday	12	4.43	0.424	237.13			
	Never	168	4.17	0.409	170.42			

of the university students had the habit of doing sport in their past lives (Ergül et al., 2015). In the current study, it was found that the state of having done sport in the past may have significant effects on their current attitudes towards sport.

The findings revealed that the psycho-social development and mental development and total attitude levels of the pre-service teachers having done sport "always" and "sometimes" are higher than those of the pre-service teachers having done sport "never". On the other hand, female pre-service preschool teachers' attitudes towards sport were found to be not varying significantly depending on their reasons for not having done sport in the past. These findings indicate that the reasons for not having done sport in the past do not affect their current attitudes towards sport; yet the habit of

Table 8. Comparison of attitudes towards sport depending on interest in sport.

Sub-dimensions	Interest in sport	N	X	Ss	Mean rank	χ^2	p
Psychosocial development	Through newspapers	19	4.18	0.417	181.74		
	Through social media	216	4.21	0.445	191.43		
	Through television	89	4.25	0.492	198.24	2.882	0.578
	Through sport contests	26	4.32	0.475	212.83		
	Not interested	33	4.13	0.498	168.38		
Physical development	Through newspapers	19	4.41	0.410	141.95		
	Through social media	216	4.56	0.454	194.11		
	Through television	89	4.60	0.433	203.27	7.006	0.136
	Through sport contests	26	4.46	0.437	162.87		
	Not interested	33	4.60	0.394	199.56		
Mental development	Through newspapers	19	3.73	0.486	148.66		
	Through social media	216	3.92	0.689	188.04		
	Through television	89	4.02	0.770	208.54	7.595	0.108
	Through sport contests	26	4.12	0.599	220.02		
	Not interested	33	3.83	0.740	176.17		
Total	Through newspapers	19	4.16	0.348	166.13		
	Through social media	216	4.25	0.417	191.35		
	Through television	89	4.29	0.433	201.52	2.718	0.606
	Through sport contests	26	4.31	0.435	204.15		
	Not interested	33	4.20	0.446	175.88		

Table 9. Comparison of attitudes towards sport depending on the existence of a family member doing sport.

Sub-dimensions	Family member	N	X	Ss	Mean rank	χ^2	p
Psychosocial development	Father	19	4.35	0.479	223.84		
	Mother	22	4.21	0.484	186.07	2.206	0.531
	Sibling	138	4.23	0.445	195.82		
	No one	204	4.20	0.469	187.09		
Physical development	Father	19	4.62	0.330	197.26		
	Mother	22	4.56	0.351	182.98	0.360	0.948
	Sibling	138	4.55	0.432	189.38		
	No one	204	4.56	0.467	194.26		
Mental development	Father	19	4.06	0.636	209.95		
	Mother	22	3.66	0.899	155.23	4.845	0.183
	Sibling	138	4.01	0.651	203.18		
	No one	204	3.91	0.711	186.73		
Total	Father	19	4.36	0.415	223.89		
	Mother	22	4.20	0.483	177.23	2.759	0.430
	Sibling	138	4.27	0.408	197.56		
	No one	204	4.24	0.423	186.86		

doing sport in the past can be argued to positively affect the current attitudes towards sport. The reason behind the positive effect of having done sport in the past on the attitudes towards sport might be because their level of

awareness of the benefits and importance of sport is higher than that of those not having done sport.

Similar findings were reported in the literature by studies conducted on young people showing that participation in sport activities positively affect the attitudes towards sport (Alpaslan, 2008; Hünük, 2006; Akandere et al., 2010). Similarly, being sedentary or active during the daily life has also been shown to be the determinants of the attitudes towards sport (Kamtsios and Digelidis, 2008).

The current study also revealed that the means through which female pre-service preschool teachers are interested in sport such as printed and visual media or sport contests do not have significant effect on their attitudes towards sport. However, their state of doing sport regularly was found to be significantly influential on their attitudes towards sport. In this connection, the findings show that psychosocial development, mental development and total attitude levels of female pre-service preschool teachers' doing sports 1 to 3 days a week are higher than those of not doing any sports.

As known well, there is a significant correlation between attitudes and behaviors (Karadağ, 2012). Thus, it is expected that of those female pre-service preschool teachers having positive attitudes towards sports do sport 1 to 3 days a week and those having poor attitudes towards sport do not participate in sports activities at all. Similar studies in the literature also reported that active participation in sport activities regular affect attitudes towards sport positively (Cimilli, 2017; Kangalgil et al., 2006; Yağcı, 2012).

The current study also found that the existence of a family member doing sport does not significantly affect female pre-service preschool teachers' attitudes towards sport. Though there are no studies investigating the same subject on university students, there are some studies conducted on secondary school students and they concluded that the existence of family members doing sport affects the attitudes towards sport positively (Çelik and Pulur, 2011; Kılıç, 2015). In the current study, however, it was found that the existence of a family member doing sport does not significantly affect female pre-service preschool teachers' attitudes towards sport and this might be because university students are physically and psychologically distant from their families and they are at their developmental process of making their own decisions.

As a conclusion, it was found that having done sport in the past and doing sport regularly at present have positive effects on female pre-service preschool teachers' attitudes towards sport. The main reason for this finding can be fact that participation in sport positively affects attitudes towards sport and the findings of the study concur with the relevant literature. In light of the findings of the study, the following suggestions can be offered.

1. Some arrangements can be made to impart the awareness of sport to female pre-service preschool teachers so that their attitudes towards sport can be enhanced. In addition, the course "Physical Education and Games" offered just for one term to pre-service preschool teachers can be extended across the teacher education programs and grade levels.
2. In order to enhance female pre-service preschool teachers' participation in sport activities, extracurricular sport activities and leisure time activities can be organized. Moreover, the number of sport facilities where students can be engaged in sport activities can be increased.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Appendix A. The scale of attitudes towards sport.

The items in this scale were developed to elicit your attitudes towards sport. Your responses to the Scale items must reflect your own opinions. While indicating your response to each item, first read the item carefully and then mark the option with (X) that reflects your opinion best. Your responses will be kept confidential and will not be used for other purposes, but only for the current study purpose. Please do not leave any item unanswered. I am grateful for your help.

1	Grade level	1st grade ( )	2nd grade ( )	3rd grade ( )	4th grade ( )
2	The state of having done sport in the past	1. Never ( )	2. Sometimes ( )	3. Always ( )	
3	If you did not do sports, why?	1. My family did not let me ( )	2. I did not have time ( )	3. Due to some economic reasons ( )	
4	I do sports regularly	1-3 days a week ( )	2. 4-6 days a week ( )	3. Every day ( )	
5	The state of interest in sports	1. I read sports news from the newspaper ( )	2. I follow sports events in the social media ( )	3. I watch sports on TV ( )	4. I go to sport contests ( )
6	The member of my family doing sports	1. Father ( )	2. Mother ( )	3. Sibling ( )	4. Nobody ( )
[1] Attitudes	[2] Strongly agree	[3] Agree	[4] Undecided	[5] Disagree	[6] Strongly disagree

		Doing sports	5	4	3	2	1
Psycho-social development	1	Helps to cope with stress.					
	2	Increases the social status.					
	3	Makes people happy.					
	4	Reduces anxiety.					
	5	Increases self-confidence.					
	6	Decreases boredom.					
	7	Increases success at work.					
	8	Increases success in social life.					
	9	Helps to control anger.					
	10	Improves emotional well-being.					
	11	Provides protection against depression.					
	12	Helps to relax.					
	13	Improves leadership characteristics.					
	14	Enables to socialize.					
	15	Raises the consciousness of responsibility in social life.					

Appendix A. Contd.

Physical development	16	Helps to control weight.					
	17	Is necessary for the physical development of children.					
	18	Increases the quality of life.					
	19	Increases the capacity of work.					
	20	Makes people fit.					
	21	Protects against illnesses.					
	22	Strengthens skeletal structure.					
Mental development	23	Promotes creativity.					
	24	Keeps the memory strong.					
	25	Enhances decision-making performance.					
	26	Improves thinking skills.					
	27	Improves strategy development skills.					

Full Length Research Paper

Evaluation of teacher candidates writing skills[1]

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In this study, 200 volunteer students who were in Faculty of Education printed free essay compositions and the compositions were evaluated by descriptive statistics and content analysis. Content analysis is to interpret similar data within specific contexts and themes. The students were free to choose their own writing topic. The reason for this is the possibility that the person writing in freelance writing is feeling freer and thus able to collect more data. Thus, written expression errors will be examined in more detail. The data have been examined and themed. In this process, collected data were evaluated according to written expression evaluation scale. The results of this study indicated that 200 data points collected from education faculty students regarding written expression skills were found between acceptable "DC" in terms of arithmetic mean. Research is important in terms of revealing the mistakes that are often found in written expressions of teacher candidates. This research is also important for lecturers in terms of assessing the participant teacher candidates' attitudes towards writing. According to the findings of this research, it is expected that the mistakes of teacher candidates' in their written expressions are made clear, and that contributions of the recommendations and the studies related to the field are expected to be provided. It is expected that the comparison of the study with the previous studies reveal the changes and developments in the historical process related to the subject.

Key words: Language skills, Turkish education, teacher candidates, writing skills.

INTRODUCTION

The human mind has the ability to interpret which combines previous knowledge with new knowledge and adapts to new events. This interpretation later becomes essential for self-explaining needs. In this sense, understanding and explaining skills comprised reading and listening under understanding skills and speaking and writing under explaining skills. These four fundamental language skills have an integral relationship. As reading and listening skills develop, speaking and writing skills will develop as well. Similarly, as writing and speaking skills develop, skills related with understanding will develop. Among these skills, writing is an essential skill for both the private and corporate life of an individual. Explaining oneself in an appropriate and accurate written format in corporate and private life would provide various gains. Additionally, written expression is the fundamental source for information sharing between generations.

"Written expression" is expressing ideas and emotions

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[1]This research is an extended full text of an unpublished study presented as an oral statement at the 9th International Turkish World Language Symposium held in November 2017, Malatya.

within language rules, using a suitable plan and in an impressive manner (Calp, 2005: 195). It is possible to evaluate written expression processes as stated subsequently.

First, the motivation for writing should be achieved and the subject should be selected. The subject should be narrowed down and an objective should be determined. The subject should be supported with their ideas and an expression order should be determined. Readings should be done for the objective evaluation of the writing (Beyreli et al., 2011: 38).

There are many forms of written expression. However, it is possible to summarise written expression types as: explanation, proving, descriptive, and narration (Dölek, 2016: 24-26).

(1) Expression with explanation is related with giving information about one subject or teaching one subject. This way of expression often uses classification, review, and comparison.
(2) Expression with proving/discussion is used for support or confute any idea, thought, or judgement.
(3) In descriptive expression, the author will add personal views in description processes and promotes readers to imagine.
(4) Narrative expression contains a main event and auxiliary events. In narrative expression, there are important elements such as time, location, and meaning.

Written expression has certain principles. Gündüz and Şimşek (2012: 31-35) described the basic principles of writing as follows: motivation for writing, necessary Turkish skills, individuality/style or making language personal, being a careful and sensitive observer, making reading a necessary and enjoyable habit, thinking about what is learned, and understanding the knowledge.

Writing works are investigated under controlled, directed, and free (Demirel, 2003: 102-108). Controlled writing requires students to preserve words and sentence structures or to make requested changes. In guided writing, students should use words and sentence structures in a controlled way and construct meaningful paragraphs. Lastly, in free writing, student should write with their own ideas and emotions by considering the writing rules. In this study, a free writing activity was applied to teacher candidates.

Coşkun (2007: 55-56) listed writing education based on the following focus points.

In product-based writing education, students should form a text. The preparation stage is skipped. The teacher has a role in determining the topic and evaluating the writings. Writing anxiety is considered unimportant. Stylistic attributes are more important than content. The relationship between writing skills and cognitive skills is disregarded. Teacher gives the topic. The student does not select the text type. Students should express the truth in the text. Writing activities of students are bounded with in-class exercises and examination and these are made for evaluation.

In process-based writing education, writing skills is considered as a process that occurs by consecutively using related activities. The preparation stage is important for process-based writing education. At this stage, students are psychologically and mentally preparade for writing. Teacher acts as a guide at every stage. Individual differences of students are considered. Content is more important than style. Students have the right to choose topic. Selecting the text type is a right for the student. Student could work with imagination without thinking of right wrong. Writing is considered as a chance for cognitive development. The objective of the evaluation is to overcome deficiencies of children. Writing is not only considered as in-class activity.

From this point of view, it could be commented that in the evaluation stage, certain expectations occur in written expression. The expectations from written expression are as follows:

(1) It should follow language rules;
(2) It should be used under a planned period;
(3) Semantic gaps of emphasis, gestures should be filled with written expression;
(4) It should follow punctuation and grammar rules;
(5) Writer should have sufficient vocabulary (İlanbey, 2016: 14-15).

These properties are considered as different evaluation scales in different studies as subsequently shown. For example, Göçer (2005:241) considered the following as an evaluation scale of written expression:

(1) Plan, title, introduction, body, conclusion, beauty of the text, page order.
(2) Perspective; emotion, idea, observing, impression, and benefiting from design.
(3) Simplicity and naturality in expression; word and sentence knowledge.
(4) Understanding the subject, explaining with original examples; content integrity between paragraphs.
(5) Spelling and punctuation.

As teachers in the Turkey have no common writing approach, this problem is one of the most important obstacles for planned and consistent evaluation of written expression applications. This causes the most important problem for developing written expression skills in an educational environment (Karatay, 2011: 1045).

Under the scope of this study, fundamental mistakes in written expression were evaluated using 200 participants from a sampling group. In this sense, this study is important for reflecting the fundamental mistakes in written expression. The data was evaluated for the

Table 1. Table for gender distribution of participants.

Participant gender	Number
Male	52
Female	148

gender of participants. As the participants were free to choose writing style, these options reflected the text type selection of this large sample group. This study based on determining written expression mistakes was conducted on education faculty students. This sample was selected because teacher candidates will affect the next generation as role models. The aim of this research is to point out writing mistakes of teacher candidates, which is thought to be significant considering the fact that the next generation will take their teachers as their role models.

METHODOLOGY

Voluntary students in Bozok University, Education Faculty wrote free style compositions and these compositions were evaluated with descriptive statistical and content analysis. Content analysis interprets similar data under the scope of certain concepts and themes (Yıldırım and Şimşek, 2006). The reason for not providing writing topics for the students is that as the literature suggested, students who write without pre-determined topic were feeling free and generate more data. Thus, written expression mistakes could be evaluated in detail. Data were analysed and themed.

Study group

In this study, a 200-person sample student group from Bozok University Education Faculty Class Teaching, Pre-School Teaching, and Mathematics Teaching and Science Teaching departments was selected on a voluntary basis. This study was conducted with volunteer students from different years who were attending Bozok University, Education Faculty during the 2017/2018 academic year (Table 1).

Data collection tools

Data collected in this study were evaluated using the "Written Expression Evaluation Form" developed by Cemal Yıldız (2008) in Turkish Education from Theory to Application Based on New Education Program book.

Data collection and analysis

Data were analysed using descriptive statistic and content analysis. Raw data were evaluated and coded in the data analysis process. Collected data were evaluated based on style, language-expression, spelling and punctuation titles of the Written Expression Evaluation Form. The form is presented in the Appendix. Two experts investigated the data and the arithmetic mean was calculated using Excel. The reliability was ensured by consulting three different experts. The arithmetic averages of the data

assessed by the three experts were presented in tables. The written expression assessment scores of the three researchers were found to be similar. The average of the scores from both the researcher and two experts was measured by a student in the study. Maltepe (2007: 197) argued that students should be free to determining the writing topic. Öztürk (2007: 145) showed that students had a higher success rate when they set the topic on their own. For data richness and for promoting easy self-expression methods for students, the students freely chose text type and topic.

FINDINGS

The participant teacher candidates' written expressions were assessed by two experts on the basis of the written expressions assessment form. The arithmetic means of the scores given by the experts to 200 participant teacher candidates are presented in Table 2.

As shown in Table 2, the highest scores in Written Expression Evaluation Form was received for "main idea was given in text", "main idea and emotion was supported with auxiliary idea and emotion", and "references, citations, and examples are adequate" items. The lowest scores were observed in "using related references", "selecting title", and "word repetition" items. General score was Acceptable-DC, which could be considered as unsuccessful.

Students' scores were assessed considering the grade units used in Turkish undergraduate education: AA 4.00 90-100 High Achievement; BA 3.50 85-89 Very Good; BB 3.00 80-84 Good; CB 2.50 75-79 Above Average; CC 2.00 70-74 Average; DC 1.50 65-69 Passing Grade-Average; DD 1.00 60-64 Passing Grade; FD 0.50 50-59 Weak; FF 0.00 00-49 Very Weak.

Table 3 shows the text type selection of teacher candidates for their written expression. It was observed that students in the education faculty often preferred essays in written expression. When male participants were considered (Table 4), most of the participants were at a very poor level. When female participants were considered (Table 5), most of the participants were in a poor or very poor level. However, there were excellent level participants with few differences.

DISCUSSION

The results of this study indicated that 200 data points collected from education faculty students regarding written expression skills were found between Acceptable "DC" in terms of arithmetic mean. Similarly, Çamurcu (2011: 515-516) determined that when compositions of first grade Turkish Education Department students were investigated, Turkish teacher candidates had low written expression skills. When second compositions were evaluated, it was determined that written expression skills of students could be developed from the beginning of the

Table 2. The arithmetic means of teacher candidates' written expression achievement scores

Scale items	Arithmetic mean
Appropriate margins are left between paragraphs and sentences. - 5p	3.4
Good, readable, and functional handwriting is used. -5p	3.4
Title is related with topic. -5p	3.2
Topic was explained in logical consistency and integrity. -5p	3.6
Appropriate connections were made between paragraphs. -5p	3.5
Single idea-emotion was included in each paragraph. -5p	3.5
Main idea was given in text. -10p	6
Main idea and emotion was supported with auxiliary idea and emotion. -10p	5.8
References, citations, and examples were adequate. -10p	5.7
The conclusion sentence summed the topic and was effective. -5p	3.6
Sentence structures were compliant with grammar rules. -5p	3.4
Words were used correctly and with correct meaning. -5p	3.5
There were no word repetitions in sentences. -5p	3.2
Resources were used about the topic. -5p	2.7
Unique statements were used for explaining the topic. -5p	3.3
Spelling rules were followed. -5p	3.6
Punctuation was correct. -5p	3.5
Total	65.4

Table 3. Text type selection of teacher candidates for written expression.

Type	Participant number
Memoir	4
Essay	184
Interview	5
Story	5
Fairy tale	1
Biography	1

term until the end.

The results of this study indicated that most of the students in the education faculty preferred to express themselves using essay. The data of the study showed that writing skills of female participants were higher than writing skills of male participants (Tables 4 and 5).

Can (2012) evaluated written expressions of 524 students in 9 and 10th grade in terms of paragraph coherency, consistency, and idea development techniques. This study showed that students had significant problems regarding coherency and consistency of the paragraphs.

Arıcı (2008) evaluated written expression mistakes for individual distribution. The results of that study showed that most of the students had spelling mistakes (68.6%), planning mistakes (37.3%), approximately one third had problems finding main idea and supporting ideas (31.3%), approximately one fourth had problems with sentence structure and bad handwriting (27.7%), again approximately one fourth had punctuations problems (24.1%), one out of five students had problems with paper order (19.2%) and 7.2% had problems with selecting a title. Although different topics and methods were used, the results showed that there are significant problems at every level of writing skills.

Kellogg (2008: 22) said that like this study's result, writing involves multiple representations and processes, with limitations in working memory constraining skill development. Advanced writing skills require systematic training as well as instruction so that executive attention can successfully coordinate multiple writing processes and representations. Finally, the principles of deliberate practice and cognitive apprenticeship offer writing educators the means to train writers to use their

Table 4. Point range of male participant.

Point range of male participant	Number
90-100 Excellent-AA	3
85-89 Very Good-BA	3
80-84 Good-BB	4
75-79 Intermediate-Good-BB	3
70-74 Intermediate-CC	6
65-69 Acceptable-Intermediate-DC	6
60-64 Acceptable-DD	5
50-59 Poor-DF	5
00-49 Very Poor-FF	17

Table 5. Point range of female participant.

Point range of female participant	Number
90-100 Excellent-AA	24
85-89 Very Good-BA	8
80-84 Good-BB	14
75-79 Intermediate-Good-BB	8
70-74 Intermediate-CC	9
65-69 Acceptable-Intermediate-DC	12
60-64 Acceptable-DD	15
50-59 Poor-DF	29
00-49 Very Poor-FF	29

knowledge effectively during composition.

Rao's (2007: 100) study's data demonstrated that explicit instruction of brainstorming strategy had a measurable influence on writing performance. The attitudinal survey also indicated that the students felt positive about the brainstorming strategy. It is suggested that EFL teachers in universities or colleges should move from a product-based approach to a process-focused approach in their teaching of writing as the latter may contribute towards activating students' thinking and creating ideas for a writing task. In this study, it can be said that brainstorming can be used to improve written expression skills.

RECOMMENDATIONS

While the written expression papers of education faculty student are examined, the mistakes should be shown to students. Writing about topics that will interest the students will increase the frequency of writing and contribute to written expression skills. As listening and reading skills of students in the education faculty are increased, deep understanding levels could be supported. Activities including developing written expression skills in different text types should be included in the classes.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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APPENDIX

Written expression evaluation form

Name surname:

Class:

Style	Properties to be searched in written expression	Adequate point	Point given by teacher
	Appropriate margins are left between paragraphs, and sentences.	5	
	Good and readable handwriting was used.	5	
	Language and Expression is related with topic.	5	
	Topic was explained in logical consistency and integrity.	5	
	Appropriate connections were made between paragraphs.	5	
	Single idea-emotion was included in each paragraph.	5	
	Main idea was given.	10	
	Main idea and emotion was supported with auxiliary idea and emotion.	10	
	References, citations, and examples were adequate.	10	
	The conclusion sentence summed the topic and was effective.	5	
	Sentence structures were compliant with grammar rules.	5	
	Words were used correctly and with correct meaning.	5	
	There were no word repetitions in sentences.	' 5	
	Resources were used about the topic.	5	
	Unique statements were used for explaining the topic.	5	
	Spelling rules were followed.	5	
	Punctuation was correct.	5	

NOTE: Points given in the scale are provided as examples. The points could be changes by teacher.

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