2019

Volume 12,
Issue 4

Kuramsal
Eğitimbilim Dergisi
JOURNAL OF THEORETICAL EDUCATIONAL SCIENCE

Afyon Kocatepe University
Faculty of Education

ISSN: 1308-1659

http://www.keg.aku.edu.tr

KURAMSAL EĞİTİMBİLİM DERGİSİ[*]
Journal of Theoretical Educational Science
ISSN: 1308-1659

[*] **Journal of Theoretical Educational Science** is a quarterly peer-reviewed online journal.

Abstracting and Indexing
ULAKBİM TR Dizin, EBSCO, ERIH Plus, Index Copernicus, DRJI, DOAJ, Türk Eğitim İndeksi (TEİ), SOBIAD, Google Scholar

Redactions
Res. Asst. Mehmet Ertürk GEÇİCİ

Address
Afyon Kocatepe Üniversitesi, Eğitim Fakültesi, A.N.S. Kampüsü, 03200 Afyonkarahisar, Turkey
Tel: +90 272 2281418
e-mail: editorkebd@gmail.com

CONTENTS

FROM THE EDITOR

Dear Distinguished Researchers and Readers,

JTES-KEG has strengthened over the past few years in terms of impact and the number of published articles. This issue marks a new change for our journal. Now, you can see that all published articles are in English in our journal, and we will initiate our applications for prestigious indexes such as ERIC and ESCI. The change in the medium of publication as English, as we expected, has shortened the review and publication process up to nine months. This nine-month process is even shorter due to our OnlineFirst system in which we publish articles earlier than its normal issue.

Furthermore, we have reinforced and diversified our editorial board with many members from different universities in Turkey and the world, and I would like to say welcome to the new members of our journal. This editorial change is expected to augment the international visibility of our journal and the spread of our authors' articles. We also like to announce that we will go on these changes until the board takes the last version.

In this issue, we decided to publish 11 research/review articles to finish all the submissions from 2018. We hope that these articles published in the last issue of 2019 will contribute to the literature. Also, we will continue to show accepted manuscripts in OnlineFirst soon.

Finally, we should also express our sincere thanks to the Editorial Board, reviewers and authors for their invaluable contributions. We also look forward to receiving submissions of sufficient rigor and quality. See you at the 2020 January issue!

Fatih GÜNGÖR, PhD
Afyon Kocatepe University
Faculty of Education

Journal of Theoretical Educational Science, 12(4), 1142-1163, October 2019
Kuramsal Eğitimbilim Dergisi, 12(4), 1142-1163, Ekim 2019
[Online]: https://dergipark.org.tr/akukeg
DOI number: http://dx.doi.org/10.30831/akukeg.529092

Developing a Questionnaire to Evaluate Turkish Students' Mathematics Values and Preferences

Türk Öğrencilerin Matematiksel Değer ve Tercihlerini Değerlendirmek İçin Bir Ölçeğin Geliştirilmesi

Yüksel DEDE[*] **Tasos BARKATSAS**[**]

Received: 19 February 2019 **Research Article** **Accepted:** 29 May 2019

ABSTRACT: The aim of this study was to construct a questionnaire: the mathematics values questionnaire (MVQ). Because a little is known about students' mathematics values and no assessment tool is available to measure students' mathematics values to obtain more insight into their perspectives. For this, the proportional stratified random sample of the study consisted of Grade 5 (11-12 years old) and Grade 9 (14-15 years old) students attending schools in Turkey. The data were subjected to descriptive and inferential statistical analyses by using a recently developed and validated survey instrument. The questionnaire's structural and predictive validities were investigated using a Principal component analysis (PCA) and an item analysis (item-total correlations and comparison of differences in means for distinctly different groups). Six components were extracted: relevance (C1), practice (C2), information and communications technology (ICT) (C3), feedback (C4), learning approach (C5), and consolidating (C6). Our results showed that Grade 5 students placed more importance than Grade 9 students for all the six value components.

Keywords: mathematics values, questionnaire development, students, validation, values.

ÖZ: Bu çalışma, matematiksel değerler ölçeğini geliştirmeyi amaçlamaktadır. Zira öğrencilerin matematiksel değerleri hakkında çok az şey bilinmektedir ve öğrencilerin kendi perspektiflerinden onların matematiksel değerlerini belirlemeye çalışan ölçme araçları da fazla yoktur. Bu bağlamda; bu çalışmanın katılımcıları, Türkiye'de 5. (11-12 yaş) ve 9. (14-15 yaş) sınıflarda okuyan ve tabakalı seçkisiz örnekleme yöntemine göre seçilen öğrencilerden oluşmuştur. Veriler, betimsel ve yordayıcı istatistiksel analizler kullanılarak analiz edilmiştir. Ölçeğin, yapısal ve yordama geçerliği, Temel Bileşenler Analizi ve Madde Analizi (madde- toplam korelasyonları ve farklı grupların aritmetik ortalamalarındaki farklılıkların karşılaştırılması) kullanılarak incelenmiştir. 6 bileşen elde edilmiştir: uygunluk, pratik, bilgi ve iletişim teknolojisi, geribildirim, öğrenme yaklaşımı ve pekiştirme. Çalışmanın sonuçlarından biri, 5. sınıf öğrencilerinin 9. sınıf öğrencilerine göre 6 değer bileşenini de daha önemli gördüklerini ortaya koymaktadır.

Anahtar kelimeler: matematiksel değerler, ölçek geliştirme, öğrenciler, geçerlik, değerler.

[*] *Corresponding Author*: Prof. Dr., Gazi University, Ankara, Turkey, ydede@gazi.edu.tr, https://orcid.org/0000-0001-7634-4908
[**] Dr., RMIT University, Melbourne, Australia, tasos.barkatsas@rmit.edu.au, https://orcid.org/0000-0002-7936-0855

Citation Information
Dede, Y., & Barkatsas, T. (2019) Developing a questionnaire to evaluate Turkish students' mathematics values and preference. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science]*, *12*(4), 1142-1163.

ISSN: 1308-1659

Introduction

Although values are generally related to the civic, moral, religious, and ethical beliefs of the individual and although it is often thought that there is no place in the mathematics curriculum for values, they can also, indeed, facilitate effective mathematics teaching and learning (Seah, Andersson, Bishop, & Clarkson, 2016). Values are often ignored by teachers, researchers, and curriculum makers, as well as by parents in their work context (Bishop, 2016). It has been argued that education and mathematics education in particular are not value-free (Ernest, 1998; Seah & Bishop, 2002). However, values are generally taught implicitly rather than explicitly in the mathematics classroom (Clarkson, FitzSimons, Bishop, & Seah, 2000). Rokeach (1972) identified an individual value as "a type of belief that is centrally located within one's total belief system, about how one ought or ought not to behave, or about some end-state of existence worth or not worth attaining" (p. 124). Raths, Harmin, and Simon (1987) considered values as a general guide for the behaviors emerging from people's relations in their daily life and experiences. Randolph (2007) considered values as "the worth of something" (p. 259). Chin and Lin (2001) also saw values as the preference of individuals related to their personal standards of thoughts and acts that are important and worthwhile to themselves. Similarly, Seah and Andersson (2015) defined values as "the convictions, which an individual has internalized as being the things of importance and worth" (p. 169). In the same vein, Chin and Lin (2001), Seah (2002) and Swadener and Soedjadi (1988) defined values as personal preferences for stating if a thought and statement are of importance and worthwhile for the individual. In this current study, this last value definition is adopted.

The Relationships among Attitudes, Beliefs, and Values

Attitude can be described in very different ways, but it is interconnected with belief, value, interest, and opinion (Leder & Forgasz, 2006). Beliefs are the cognitive basis for attitudes, and they provide information used in forming an attitude about any object or person while values are more complex than attitudes; and concepts such as equality, justice, and symmetry are typical examples of values (Koballa & Glynn, 2007). None of these concepts can be directly observed; each must be inferred from speech, behavior, or answers given to specially designed instruments (Leder & Forgasz, 2006). Goldin (2002) distinguished attitudes, beliefs and values in mathematics education:

> … (2) *attitudes* (moderately stable predispositions toward ways of feeling in classes of situations, involving a balance of affect and cognition), (3) *beliefs* (internal representations to which the holder attributes truth, validity, or applicability, usually stable and highly cognitive, may be highly structured), and (4) *values, ethics, and morals* (deeply-held preferences, possibly characterized as "personal truths", stable, highly affective as well as cognitive, may also be highly structured). (p. 61)

Values in Mathematics Teaching and Learning Environments

The goal of values teaching at all school levels is to encourage students' awareness of having values and their corresponding relationship to the world in which they live (Harecker, 2012). It is assumed that values are inherently crucial in the learning and teaching processes, educational environments in general, and classroom affective environments in particular at all school levels. They are therefore an important

influence on the ways students choose to engage (or to not engage) with mathematics. In addition, they also play a key role in establishing a sense of personal and social identity for the student at the micro level (FitzSimons, Seah, Bishop, & Clarkson, 2001). Bishop (1996) proposed three pairs of values in the tradition of "Western" mathematics: general educational values, mathematical values, and mathematics educational values. General educational values are related to general society values such as honesty, respect, etc. Mathematical values are the three pairs of complementary values, which reflect the scientific the theoretical structure and nature of mathematical knowledge: rationalism-objectivism, control-progress, and mystery-openness (see Bishop 1988, for details). Mathematics educational values are the values related to the cultures, traditions, norms, and practices that emerged from teaching and learning mathematics (Atweh & Seah, 2008). Additionally, Bishop (1998) clearly explained in terms of some examples these values in the mathematics classroom as follows:

> …when a teacher admonishes a child for cheating in a test, the values of "honesty" and "good behavior" derive from the general educational and socializing demands of society. Then when a teacher proposes and discusses a task such as the following: "Describe and compare three different proofs of the Pythagorean Theorem" the mathematical values of "rationalism" and "openness" are being conveyed. However, there are other values being transmitted, which are specifically associated with the norms of the institutions within which mathematics education is formally conducted. (p. 34)

Education System and Mathematics Education in Turkey

In Turkey, the Ministry of National Education (Turkish: Milli Eğitim Bakanlığı-MEB) for compulsory education and the Higher Education Council (Turkish: Yükseköğretim Kurumu -YÖK) are in overall control of policy, funding, and direction. Compulsory education in Turkey is free and it was firstly extended from 5 years to 8 years in 1997. Then, it was again extended from 8 years to 12 years in 2012 and it was implemented in the 2012-2013 academic year. The first four years of compulsory education are called primary school, the second four years are called as middle school, and last four years are called high school. In this situation, 7-10 year-old students generally attend primary school, 11-14 year-old students generally attend middle school, and 15-18 year-old students generally attend high school. It can be argued that the Turkish education system is often focused on high stake exams with multiple-choice tests (Yıldırım, 2008). Therefore, students at all levels of compulsory education in Turkey have to continuously prepare to pass those multiple-choice exams. This situation may cause a lot of pressure on the students.

On the other hand, the results of large-scale national assessments such as the Basic Proficiency Test (Turkish: TYT) and Subject Proficiency Test (Turkish: AYT) that emphasize the use of knowledge and prioritize the production of new knowledge, rather than measuring the level of memorized knowledge (YÖK, 2017) and international comparative studies (e.g., Program for International Student Assessment [PISA] and Trends in International Advanced Mathematics and Science Study [TIMSS]) reported that Turkish students' mathematics achievement was lower than the students' mathematics achievement in other high-performing countries (MEB, 2003, 2007; The Organization for Economic Cooperation and Development [OECD], 2002). For example, according to the research result of PISA 2003, the mathematics average of Turkish students was 417 points while the mathematics average of the OECD countries

was 496 points (MEB, 2003). In order to overcome this issue, mathematics curricula have gradually been revised in Turkey. In this context, mathematics curriculums in the primary and secondary schools were firstly updated in 2005 and then they were lastly revised in 2013. After the last revision, the mathematics curricula focus on learner-centered teaching and multidisciplinary approaches. So, the primary mathematics curriculum includes five learning streams such as numbers, geometry, measurement and statistics, probability, and algebra, while the secondary mathematics curriculum includes three learning streams such as numbers and algebra, geometry, and data, counting, and probability. On the other hand, it was also emphasized in both the primary and the secondary curricula that students' affective development such as attitudes, self-confidence, self-regulation, and mathematics anxiety should be taken into consideration when mathematical concepts and skills are developed (MEB, 2013). With these revisions in the mathematics curricula, although Turkish students improved their mathematics average according to the results of PISA 2012 but it was still not considered enough by the Turkish authorities. Turkey was ranked 44th out of 65 countries and the mathematics average of Turkey was 448 points while mathematics average of the OECD countries was 494 points (MEB, 2013). More recently, the results of PISA 2015 indicated that the mathematics average of Turkish students had decreased compared to the results of PISA 2012. So Turkey was ranked 50th out of 72 countries and the mathematics average of Turkey was 420 points while the mathematics average of the OECD countries was 490 points (MEB, 2016).

Method

Research Design

In this study it was aimed to construct a mathematics value questionnaire for secondary and high school students in Turkey. The research and development approach was utilized to ensure the validity of the questionnaire. The main element of this method is sequential inquiry that includes design principles which was compiled from related literature. Firstly, an item pool was generated and these items were submitted to experts for face validity. Following the experts' feedback, a pilot version of the questionnaire was developed. After implementing the pilot version of the questionnaire to secondary school students, the validity and reliability analysis were conducted.

Purpose and Importance of the Study

The aim of this study was to develop a questionnaire that can measure the mathematics education values of middle and high school students. Grade 5 is the first year of middle school and Grade 9 is the first year of high school in Turkey. In this sense, the questionnaire developed in this study was developed within the scope of "What I Find Important in my mathematics learning (WIFI)" Study. The international WIFI Study was conducted using a validated questionnaire (Seah, 2013), which has been used by 21 research teams in 17 different education systems around the world (More information about the WIFI study is given in the following sections). Turkey was one of the participant countries. In this sense, it is thought that this study could develop a deeper understanding of students' values during mathematics learning from a cross-national perspective because the findings of this present study can be compared to the findings of other national studies such as Japan, Sweden, Taiwan, Hong Kong, and

Australia within the WIFI project. And such a comparison could also provide valuable information on what could be learned from educational settings and practices in different countries and cultures in order to improve students' learning of mathematics (Cai, Perry, Wong, & Wang, 2009; Correa, Perry, Sims, Miller, & Fang, 2008). Also, this study could contribute empirically to the saturation and development of theories of values in the mathematics education research literature. Moreover, the results of this study could help mathematics educators to see the big picture about values in mathematics learning and it could provide a better understanding of the values in mathematics education. Thus, curriculum-makers and teachers can plan their educational contexts and activities in terms of harnessing values in mathematics teaching and learning for middle and high school levels. In addition, it is thought that this developed questionnaire could make a significant contribution to the understanding of students' values during mathematics learning because there are not many studies measuring middle and high school students' values in the Turkish context. So this current research may add momentum to studies conducted with Turkish students to examine their mathematical values. And this study could also provide an opportunity to see whether middle and high school students in Turkey may experience change in their own values in terms of the factors of questionnaire throughout their education process.

Participants

The sample consisted of Grade 5 (11-12 year-old) students and Grade 9 (14-15 year-old) students attending schools in Turkey. Grade 5 is the first year of middle school in Turkey and Grade 9 is the first year of high school. In this way, the students' values and preferences will be investigated after graduation from elementary and middle school. The data were obtained from the Ministry of National Education of Turkey (MEB) in 2013. Due to the size of the sample, a proportional stratified random sampling was used. In stratified sampling, the population is divided into homogeneous subpopulations or strata and sample items are selected from each stratum (Cohen, Manion, & Morrison, 2000; Kothari, 2004). In this study, the geographical region was a sampling unit in the stratified sampling method while the school was the sampling unit in the random sampling method. A proportional stratified sampling method was used in this study because data were collected from seven geographical regions of Turkey. Two provinces form each region were selected. This selection was based on a study by Baday Yıldız, Sivri, and Berber (2012). The authors of the study determined social and economic development index rankings for provinces of Turkey. Based on this index, the two provinces that had the highest and the lowest index rankings were chosen from each of the seven geographic regions of Turkey. For example, in the Marmara Region, the Istanbul province (highest index) and the Sakarya province (lowest index) were chosen. A similar process was used for the remaining six regions, in order to determine the 14 provinces to be included in the sample. Each province's representation rate was calculated based on the stratified sampling by taking into consideration the number of students (Grade 5 and Grade 9) in the general population (81 provinces). A similar process was used for the target population (14 provinces). Finally, the total number of students in Grade 5 and Grade 9 in the sample was multiplied by the representing proportion in the target population of each province. In this way, the sample size for each province was calculated and the proportion of the strata in the population was the

same as the proportion in the sample. A total of 1017 students (506 Grade 5 and 511 Grade 9) from14 provinces of Turkey participated in the study. Students were recruited from government middle and high schools (Grade 5 and Grade 9 respectively) and they were from all socio-economic levels. Table 1 provides the representation of student groups for each province in the sample.

Table 1

The Sample

Province	Grade 5				Grade 9			
	Number of Students	Representing proportion in the total population (Turkey)	Representing proportion in the target population	Number of Students in the Sample	Number of Students	Representing proportion in the total population (Turkey)	Representing proportion in the target population	Number of Students in the Sample
Afyon	11594	0.89	2.27	11	11510	0.87	2.14	11
Ankara	71147	5.49	13.92	70	83108	6.30	15.45	77
Antalya	31485	2.43	6.16	31	35502	2.69	6.60	33
Bayburt	6588	0.10	1.29	6	7428	0.12	1.38	7
Bolu	9820	0.29	1.92	10	10283	0.34	1.91	10
Elazığ	9823	0.76	1.92	10	12383	0.94	2.30	12
Gaziantep	40788	3.15	7.98	40	36347	2.75	6.76	34
İstanbul	211866	16.35	41.45	207	230100	17.43	42.78	214
İzmir	52361	4.04	10.24	51	63436	4.81	11.79	59
K.Maraş	22672	1.75	4.44	22	20150	1.53	3.75	19
Muş	12309	0.95	2.41	12	6526	0.49	1.21	6
Sakarya	15043	1.16	2.94	15	15512	1.18	2.88	14
Şırnak	13909	1.07	2.72	14	8622	0.65	1.60	8
Yozgat	7756	0.60	1.52	8	8592	0.65	1.60	8
Total	517161	39.03	100.00	506	549499	40.75	100.00	511

Instrument Development

The development sequence of the mathematical values questionnaire includes design principles, which was derived from related literature. The items were developed by taking into account the targeted group's context and language. An item pool was constructed and translated. The validity and usability of selected items was revised according to experts' feedbacks. Pilot version of the questionnaire was tested; these

results were used for this study - students' mathematics values questionnaire (MVQ) - in the creation of an experimental version.

Structure of the MVQ and the WIFI study. As indicated above, the questionnaire developed in this study was developed within the scope of the WIFI Study. The study was conducted to investigate what students from differing cultures valued most (Zhang, Barkatsas, Law, Leu, & Seah, 2016). The target of the WIFI study has been to find out what 11-12-year-old students (Grade 5) and 14-15-year-old students (Grade 9) value in their mathematics learning experiences. The WIFI Study was also based on Bishop's (1996) pairs of complementary mathematical values (rationalism-objectivism, control- progress, openness-mystery) and Hofstede's (2009) cultural dimensions (power distance index, individualism vs. collectivism, masculinity vs. femininity, uncertainty avoidance index, long term orientation vs. short term orientation). The WIFI questionnaire consists of four sections. Section A consists of 64 five- point Likert items (from absolutely important = 1 to absolutely unimportant = 5) to indicate the extent that the students find something important in mathematics and mathematics learning. For example, item 3 of Section A of the WIFI questionnaire asks respondents to indicate how they personally find 'small group discussions' from absolutely important to absolutely unimportant. For this item, a respondent's choice will indicate the extent to which s/he values the mathematical value of openness. Section A with 64 items includes a learning activity in mathematics and mathematics learning such as alternative solutions (item 15) and whole-class discussions (item 7). In here, low scores indicate a high importance value in mathematics and mathematics learning. Section B consists of 10 continuum dimension items while Section C includes an open-ended question, common and contextualized in a scenario with 4 items. Finally, Section D includes questions about personal features (e.g., nationality, gender, grade level, and age). In this study, the results of Section A will be reported.

To provide a validation of the questionnaire during this process, the results of the Principal Component Analysis (PCA), item analysis and reliability analyses were used to verify that the resulting questionnaire was a valid and reliable instrument.

Validation of the MVQ. The validity of a questionnaire includes language validation, cultural adaption and instrument psychometry to ensure understandability of the items, to measure expected construct and how the expected construct was consistently measured. Linguistic considerations included translations and back-translations. Validity and reliability were examined with different approaches.

Language and cultural adaptation. To use the WIFI questionnaire in a Turkish context required a translation and a cultural adaptation. As a consequence, the TRAPD Team Translation Model (Harkness, Villar, & Edwards, 2010) was used. The steps in the TRAPD model are; *Translation*, where two translators make two independent translations; *Review*, where the translations are compared and refined; *Adjudication*, where the translation is separated from review with focus on, amongst other things, *a cultural adaptation*; *Pilot test* and finally *Documentation* of every step in this process. In addition, the challenges in the translation and cultural adaptation processes of an international survey were also considered (Andersson & Österling, 2014).

Content validity. Three experts used a checklist by panel to ensure content validity of the instrument. The panel members were university staff who gave math courses, education measurement and evaluation, or Turkish language courses. The expressions of the items were also evaluated in terms of the relevancy, fluency and appropriateness of the language structure. Based on the opinions of the experts, some of the items were rewritten or rearranged according to the Turkish context and none of the items were deleted, for example:

#9: "Mathematics debates were rewritten as mathematics debates" (discussion of opposing ideas).

Pilot Study: After alterations based on the experts' suggestions, the Turkish pilot version was explored with 42 middle and high school students. The pilot study revealed that the students had not understood some of the statements, for example:

#3: "Small group discussions were rewritten as small group discussions" (different but not contradictory ideas).

Structural and predictive validity. The analysis of structural and predictive validity of MNQ were made in two ways: exploratory factor analysis and item analysis (item-total correlations and comparison of mean differences for significantly different groups). The revised questionnaire was implemented to 506 5^{th} grade and 511 9^{th} grade students, totally 2017 students. Kaiser-Mayer-Olkin Approach (KMO) and the Barlett's Sphericity Test (BTS) measures firstly examined to check the sample size adequacy for factor analysis. The results were shown [KMO = 0.938) and BTS ($p < 0.001$)] that the sample was adequate to run a factor analysis. Exploratory factor analysis was employed to examine the subscales of the questionnaire and verify the psychometric structure of the MVQ.

Items analysis methods, useful approaches to verify an instrument's predictive validity, revealed that items contributed to the total measures and items and sub-dimensions of scales were sensitive to expected differences. The item correlation scores and the total score were assessed to demonstrate the correlations between item score and the total MVQ scores. The sensitivity of the instrument and the differences between high and low performed groups were compared by second item analysis. Thus, based on total MVQ scores the students were divided in to three groups (top 27% = high, middle 46% = moderate, and bottom 27% =low). The group differences according to each subscale were examined with ANOVA. By using ANOVA it was aimed to establish each subscale's and item's capacity to differentiate between high and low performed individuals.

Results

The results are presented in two ways: the verification of the instrument and the findings related to students' mathematics values.

The Validation of the Students' Mathematics Values Questionnaire (MVQ)

To show that the MVQ was a valid and reliable instrument, the findings of the principal component analysis, item analyses, reliability analyses, and correlations among the components were performed on items and subscales.

Principal component analysis (PCA). A PCA with a Varimax rotation was used to ensure that the factors remain uncorrelated. The Varimax rotation resulted in six components with eigenvalues greater than one, which accounted for 40.97% of the total variance, with the first component (C1) accounting for 14.93% of the variance, the second component (C2) accounting for 12.06%, the third component (C3) accounting for 4.40%, the fourth component (C4) accounting for 3.43%, the fifth component (C5) accounting for 3.11%, and the sixth component (C6) accounting for 3.02%. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.943 and the Bartlett's Test of Sphericity (BTS) was statistically significant ($p<0.001$) and so factorability of the matrix was assumed.

Four items were deleted due to double-loading. The deleted items: #5: "Teacher explains to the whole class", #8: "Learning the proof", #27: "Different ways of solving a problem", and #41: "Teacher helps me individually. Communalities (h^2) of items were between 0.22-0.73 and item-total correlations were between 0.27- 0.60 (see Table 2).

Table 2

PCA and İtem-Total Correlations: Rotated Factor Loadings, Communalities (h^2), İtem-Total Correlations, Means, and Standart Deviations (SD) for the 60 Retained İtems

Item	Component						h^2	Item -Total Correlation	Mean	SD
	1	2	3	4	5	6				
Q39LookingOutForMathsInRealLife	0.734						0.350	0.402	2.07	1.12
Q61StoriesAboutMathematicians	0.731						0.342	0.308	2.54	1.33
Q17StoriesAboutMathematics	0.729						0.355	0.423	2.63	1.25
Q18StoriesAboutRecentDevelopmentsInMathematics	0.721						0.394	0.275	2.50	1.21
Q62CompletingMathematicsWork	0.693						0.221	0.355	1.93	1.08
Q11AppreciatingTheBeautyOfMathematics	0.672						0.363	0.479	2.03	1.13
Q34OutdoorMathematicsActivities	0.653						0.370	0.454	2.14	1.17
Q12ConnectingMathsToRealLife	0.637						0.310	0.460	1.98	1.07
Q21StudentsPosingMathsProblems	0.588						0.513	0.489	1.99	1.09
Q20MathematicsPuzzles	0.581						0.479	0.455	1.96	1.01
Q57MathematicsHomework	0.580						0.448	0.409	1.91	1.14
Q1Investigations	0.546						0.416	0.334	1.77	0.89
Q26RelationshipsBetweenMathsConcepts	0.532						0.377	0.462	1.88	0.92
Q9MathematicsDebates	0.514						0.321	0.454	2.17	1.07
Q10RelatingMathematicsToOtherSubjectsInSchool	0.498						0.601	0.515	2.19	1.15
Q19ExplainingMySolutionsToTheClass	0.472						0.595	0.548	1.76	0.96
Q29MakingUpMyOwnMathsQuestions	0.471						0.382	0.488	2.07	1.15
Q25MathematicsGames	0.458						0.427	0.477	2.40	1.21
Q32UsingMathematicalWords	0.448						0.445	0.467	1.63	0.87
Q47UsingDiagramsToUnderstandMaths	0.420						0.469	0.397	1.72	0.89
Q59KnowingTheTheoreticalAspectsOfMathematics	0.409						0.734	0.455	1.69	0.92
Q40ExplainingWhereTheRulesFormulaeCameFrom	0.404						0.706	0.423	1.89	1.01
Q60MysteryOfMaths	0.402						0.429	0.481	1.75	1.07
Q36PractisingWithLotsOfQuestions		0.642					0.463	0.519	1.36	0.61
Q13PractisingHowToUseMathsFormulae		0.611					0.310	0.290	1.47	0.82
Q58KnowingWhichFormulaToUse		0.603					0.397	0.375	1.35	0.62
Q43MathematicsTestsExaminations		0.596					0.433	0.471	1.43	0.79
Q50GettingTheRightAnswer		0.586					0.338	0.386	1.31	0.65
Q63UnderstandingWhyMySolutionIsIncorrectOrCorrect		0.563					0.361	0.448	1.47	0.80
Q2Problemsolving		0.547					0.359	0.425	1.35	0.60
Q54UnderstandingConceptsProcesses		0.539					0.480	0.513	1.46	0.74
Q37DoingALotOfMathematicsWork		0.537					0.361	0.400	1.50	0.76

Q49ExamplesToHelpMeUnderstand	0.533					0.473	0.390	1.45	0.74
Q38GivenAFormulaToUse	0.530					0.442	0.473	1.50	0.77
Q33WritingTheSolutionsStepbystep	0.486					0.331	0.362	1.63	0.92
Q42WorkingOutTheMathsByMyself	0.467					0.564	0.486	1.58	0.83
Q56KnowingTheStepsOfTheSolution	0.466					0.342	0.470	1.30	0.57
Q55ShortcutsToSolvingAProblem	0.428					0.298	0.379	1.49	0.78
Q30AlternativeSolutions	0.428					0.456	0.395	1.70	0.85
Q35TeacherAskingUsQuestions	0.416					0.592	0.514	1.41	0.68
Q64RememberingTheWorkWeHaveDone	0.413					0.564	0.530	1.50	0.82
Q28KnowingTheTimesTables	0.407					0.213	0.284	1.33	0.75
Q6WorkingStepbystep	0.400					0.462	0.547	1.47	0.71
Q31VerifyingTheoremsHypotheses	0.381					0.452	0.601	1.93	1.01
Q46MeAskingQuestions	0.358					0.419	0.444	1.67	0.98
Q23LearningMathsWithTheComputer		0.828				0.440	0.375	3.19	1.29
Q24LearningMathsWithTheInternet		0.817				0.257	0.326	3.13	1.304
Q22UsingTheCalculatorToCheckTheAnswer		0.668				0.481	0.547	3.00	1.37
Q4UsingTheCalculatorToCalculate		0.556				0.375	0.541	3.43	1.32
Q44FeedbackFromMyTeacher			0.716			0.467	0.481	1.83	0.90
Q45FeedbackFromMyFriends			0.693			0.312	0.315	2.22	1.08
Q51LearningThroughMistakes			0.357			0.291	0.370	1.59	0.94
Q14MemorisingFacts				0.468		0.460	0.448	1.59	0.93
Q16LookingForDifferentPossibleAnswers				0.411		0.369	0.315	2.03	0.96
Q15LookingForDifferentWaysToFindTheAnswer				0.408		0.357	0.478	1.59	0.80
Q3SmallgroupDiscussions				0.386		0.280	0.407	2.19	0.97
Q7WholeclassDiscussions				0.372		0.581	0.520	2.16	0.97
Q52HandsonActivities					0.550	0.574	0.553	1.87	1.01
Q53TeacherUseOfKeywords					0.418	0.445	0.418	1.69	0.96
Q48UsingConcreteMaterialsToUnderstandMathematics					0.412	0.323	0.420	1.91	0.98

The six components were named as follows:

Component 1 (Relevance). The first factor (F1) includes 23 items with a reliability coefficient 0.93, which explains 14.93 % of the total variance. This component focuses on certain learning activities or materials relevant to mathematics learning, such as mathematical stories (Q17, Q61), games (Q25), puzzles (Q20), outdoor mathematics activities (Q34) and mathematics in real life (Q12).

Component 2 (Practice). This component consists of 22 items with a reliability coefficient 0.89, which explains 12.06% of the total variance. This component focuses on the importance of practice and problem solving activities with regard to mathematics and mathematics learning, such as practicing with lots of questions (Q36), mathematics tests examinations (Q43), knowing the steps of the solution (Q56) and shortcuts to solving a problem (Q55).

Component 3 (Information and Communication Technology - ICT). The third component includes 4 items with a reliability coefficient 0.75, which explains 4.40% of the total variance. This component reflects the use of technology during mathematics learning, such as learning mathematics with the computer (Q23), learning mathematics with the internet (Q24) and using the calculator to calculate (Q4).

Component 4 (Feedback). The fourth component consists of 3 items with a reliability coefficient 0.58, which explains 3.43% of the total variance. This component

focuses on receiving feedback from teachers and student partners or learning through mistakes during mathematics learning (Q44, Q45, and Q51 respectively).

Component 5 (Learning Approach). The fifth component includes 5 items with a reliability coefficient 0.56, which explains 3.11% of the total variance. It focuses on the importance of discussion environments (Q3), small or whole class discussions (Q7), and to look for different possible answer or different ways to find the answer during mathematics learning.

Component 6 (Consolidating). The sixth component consists of 3 items with a reliability coefficient 0.62, which explains 3.02% of the total variance. This component focuses on *consolidating* during mathematics learning, such as using concrete materials to understand mathematics (Q48) and hands on activities (Q52).

Item Analysis

The correlations between the total score and each item score were computed to show the associations between the total questionnaire and individual items. The second item analysis compared the differences between lower and upper performance groups and the sensitivity of the questionnaire. Therefore, the 1010 respondents were divided into three groups based on their total questionnaire scores (low = bottom 27%, moderate = middle 46%, and high = top 27%) and the group differences on each sub-factor were analyzed by a multivariate analysis of variance (MANOVA) to determine the consistency of the statistically significant differences and to establish each sub-factor and item's ability to differentiate between low and high values. The MANOVA indicated that there were statistically significant differences among students with low, moderate, and high values in mathematics learning for the six components and that the effect sizes of the values for the entire questionnaire and the six factors were large (Fan, 2001). The effects of the components [Component 1: $F(2,1007)= 452.02$, $p<0.001$, $\eta^2 = 0.47$; Component 2: $F(2,1007) = 262.27$, $p< 0.001$, $\eta^2 = 0.34$; Component 3: $F(2,1007) = 159.81$, $p<0.001$, $\eta^2 = 0.24$; Component 4: $F(2,1002) = 194.60$, $p<0.001$, $\eta^2 = 0.27$; Component 5: $F(2,1007) = 341.77$, $p< 0.001$, $\eta^2 = 0.40$; Component 6: $F(2,1007) = 423.63$, $p<0.001$, $\eta^2 = 0.45$) and the entire scale $F(2,999) = 1963.68$, $p< 0.001$, $\eta^2 = 0.79$] supported the claim that the questionnaire could distinguish among low, moderate, and high values.

Internal Consistency (Cronbach's α). Table 3 shows the means, standard deviations (SD), variance, kurtosis, skewness, and internal consistency (Cronbach's α) for the entire questionnaire and its components. The acceptable Cronbach's α (coefficients > 0.60) for the entire questionnaire and the six components confirmed the satisfactory internal consistency of the questionnaire (Table 3).

Table 3

Internal Consistency (Cronbach's α), Means, and Standart Deviations (SD), Skewness, and Kurtosis for the Questionnaire

Questionnaire	Item no	Mean	*SD*	Skewness	Kurtosis	Variance	*α*
Component 1	23	2.02	0.67	0.70	0.22	0.45	0.93
Component 2	22	1.48	0.43	1.81	5.64	0.18	0.89
Component 3	4	3.18	1.01	-0.06	-0.64	1.02	0.75
Component 4	3	1.87	0.73	0.89	0.70	0.54	0.58
Component 5	5	1.91	0.56	0.62	0.82	0.32	0.56
Component 6	3	1.82	0.76	1.08	1.11	0.58	0.62
Entire Questionnaire	60	2.05	0.46	0.40	1.15	0.21	0.94

The results of the correlations between the questionnaire components showed that there was a positive and significant correlation among the questionnaire components. The components were generally lower and moderately correlated. However, there were significant and positive associations (r = 0.63, p<0.01; r = 0.11, p<0.01; r = 0.32, p<0.01; r = 0.60, p<0.01; r = 0.61, p< 0.01) between component 1 and other components, respectively. There was also a significant and positive relationship (r=0.43, p<0.01; r = 0.53; p<0.01; r = 0.54; p<0.01) between component 2 and components 4-6, respectively and component 3 and components 4-6 (r = 0.13, p<0.01; r = 0.15; p<0.01; r= 0.15; p <0.01), respectively. Similarly, there was a significant and positive relationship (r = 0.33, p<0.01; r=0.29; p<0.01) between component 4 components 5-6, respectively and component 5 and component 6 (r = 0.44, p<0.01). On the other hand, there was no significant relationship (r= 0.00, p>0.05) between component 2 and component 3. Collectively, these findings indicate that the questionnaire is a valid and reliable instrument in identifying values in mathematics and mathematics learning.

Turkish Students' Mathematics Values

The results are presented in two ways: grade level differences and gender differences in terms of students' mathematics values.

Grade Level Differences. A MANOVA was conducted for each independent and dependent variable pair. A Bonferroni alpha level was used as 0.05/6=0.008 in the analysis of these findings (Pallant, 2007). The analysis indicated that there were statistically significant differences for each of the following components by Grade Level: Component 1 with large effect size, and components 2, 5, and 6 with medium effect sizes, F(1,1000)=591.59, p<0.001, η^2=0.372; F(1,1000)=66.21, p<0.001, η^2=0.062; F(1,1000)= 98.38, p<0.001, η^2= 0.090; F(1,1000) =154.90, p<0.001, η^2= 0.134, respectively (η^2=0.372 indicates that 37.2% of the variation in Component 1 can be explained by differences between Grades). There were no statistically significant differences between Grade Level and Components 3 and 4 (F (1, 1000) = 0.43, p>0.05; F (1,1000) = 6.45, p<0.01), respectively. A Tukey Honest Significant Difference (HSD)

post hoc multiple comparisons test was performed in order to explore differences for each value dimension. It was found that Grade 5 and Grade 9 students' scores had significantly different mean values for Component 1 (Relevance).

Considering the mean scores, it was concluded that Grade 5 students had lower mean scores (indicating a high degree of importance) than Grade 9 students for all the six components, with mean values 1.63 (Grade 5) compared to 2.45 (Grade 9), 1.38 (Grade 5) compared to 1.59 (Grade 9), 3.16 (Grade 5) compared to 3.20 (Grade 9), 1.82 (Grade 5) compared to 1.94 (Grade 9), 1.75 (Grade 5) compared to 2.09 (Grade 9), and 1.56 (Grade 5) compared to 2.12 (Grade 9), respectively. In terms of the five-point Likert-type scale, these mean scores showed that the values expressed on the six components (except for the ICT factor, with a mean value of 3.16), were very positive for Grade 5 students, while the practice and feedback components were very positive, the relevance, learning approach, and consolidating were positive, and ICT factor was almost somewhat neutral for Grade 9 students. Furthermore, the mean scores of practice in both Grade 5 and Grade 9 students were also the lowest compared to the other five components. According to these results, both Grade 5 and Grade 9 students see practice as the most important value for their mathematics and mathematics learning within six components. Conversely, ICT component was valued least by both Grade 5 and Grade 9 students when compared to the other five components. The descending order of the mean scores (low scores indicate a high degree of importance during mathematics learning) for Grade 5 and Grade 9 were practice-consolidating-relevance-learning approach-feedback-ICT and practice-feedback- learning approach-consolidating-relevance-ICT, respectively (for further details see Table 4).

Gender. No statistically significant differences between gender and any of the six components were found, indicating that students' valuing was gender neutral.

Table 4

Grade 5 and Grade 9 Means and Standard Deviations for the Six Value Components

Component	Student				F Test	Effect Size (η^2)
	Grade 5		Grade 9			
	Mean	*SD*	Mean	*SD*		
Relevance	1.63	0.45	2.45	0.61	591.59, p=0.000	η^2 = 0.372, Grade 5 < Grade 9
Practice	1.38	0.36	1.59	0.47	66.21, p=0.000	η^2 = 0.062, Grade 5 < Grade 9
ICT	3.16	1.07	3.20	0.94	0.43, p=0.510	-
Feedback	1.82	0.75	1.94	0.70	6.45, p=0.011	-
Learning Approach	1.75	0.53	2.09	0.54	98.38, p= 0.000	η^2= 0.090, Grade 5 < Grade 9
Consolidating	1.56	0.60	2.12	0.81	154.90, p=0.000	η^2= 0.134, Grade 5 < Grade 9

** A low score indicates a high importance during mathematics learning.*

Discussion and Implications

The results showed that the MVQ consists of six value components. These components are: Relevance (C1), Practice (C2), ICT (C3), Feedback (C4), Learning Approach (C5) and Consolidating (C6). The questionnaire items, which loaded onto the first component, are associated with the students' valuing of *relevance*. These reflect the relevance espoused by many Turkish students, which is rather well documented in the literature (e.g., Bond, 1996, Dede, 2007, 2011, 2012). Findings of the current study indicate that both Grade 5 and Grade 9 students value relevance in their mathematics and mathematics learning highly. In this regard, Turkish students want mathematics to be taught in relation to daily life. Atweh (2007) emphasized the importance of teaching mathematics in relation to everyday life as follows:

> The development of mathematical knowledge through real world activities demonstrates the usefulness of mathematics at the same time as engaging students. Further, this engagement of mathematics with the life of the student should be an engagement not only with the physical world and the economic world, but also with the social world; not only with the world as the student will experience as an adult, but their current world; it should aim at developing an understanding not only of mathematics but also an understanding of the world. (p. 9)

The second value component is *practice* and its valuing is reflected in ways that the student respondents emphasize the importance of mathematics in class and homework. Everyone, regardless of their abilities, has the opportunity to strive for better success in life. In addition, success at school constitutes a transition to this life-long success. Thus, entering and emphasizing practice value is an expression of efforts. However, the belief that "practice makes perfect" puts a great deal of pressure on students (Zhang et al., 2016). As indicated in the literature section, the Turkish education system is centered on the high-stakes exams. With these exams, Turkish students are measured for their mathematical skills as well as their ability to use time in the most efficient manner possible. For this reason, if students want to succeed in these exams, they should solve a lot of mathematical questions and problems. In this sense, the results of the study indicate that both Grade 5 and Grade 9 students value practice in their mathematics and mathematics learning highly.

The third component arising from the data analysis is *ICT*. The use of ICT in education has been promoted since the 1990s (Wong, 2003) and was once again the foci in the mathematics curriculum reform at the turn of the millennium (Wong, Han, & Lee, 2004). Many resources, such as the internet, computers, calculators (including Computer Algebra Systems calculators - CAS) and a range of software have been incorporated into the school system, in particular those in the Chinese regions since then, in particular to assist those who are economically disadvantaged to have access. Similarly, in Turkey, the use of ICT in education in general and in mathematics education in particular has been strongly encouraged by the MEB since the 2000s. Encouragement on the use of ICT in education is increasing on a daily basis. In this regard, the effective and proper use of ICT is one of the mathematical competences that Turkish primary and secondary mathematics programs aim to develop (see, MEB 2013). However, findings of the current study reveal that both Grade 5 and Grade 9 students value ICT in their mathematics and mathematics learning neutrally. From this perspective, it is thought that it does not replace the traditional teaching methods although ICT has been gradually incorporated into the day-to-day teaching and learning activities in Turkish educational settings. In fact, it is possible that ICT would be valued

more highly if its use was perceived as an integral part of concept development as well as an intellectually challenging tool supporting communication and exploration in realms within and beyond the classroom-and not just the routine drill and practice tool as is commonly the practice. Similar results have been reported for the three Chinese regions such as Chinese Mainland, Hong Kong and Taiwan (Zhang et al., 2016). These considerations could explain why the mean score of the ICT component is around 3.0, which means neither important nor unimportant for both the Grade 5 and the Grade 9 students.

The fourth value component is *feedback*. Turkish students also value the importance of feedback from teachers and friends. According to Hattie and Timperley (2007), feedback has a potentially significant effect on student learning. The reason that feedback is highly regarded by the students can basically coincide with earlier studies on students' preferred learning environment for mathematics (Ding & Wong, 2012; Wong, 1993). Similarly, studies in Turkish education settings indicate that type of feedback that pre-service primary school mathematics teachers prefer in mathematics classes is descriptive feedback (Çabakçor, Akşan, Öztürk, & Çimer, 2011) and Turkish mathematics teachers also use descriptive feedback in their teaching (Çetinkaya & Kögce, 2014). This feedback reflects lack of understanding and improper interpretations (Earl, 2003) and it gives students the opportunity to learn about current achievements in reaching an objective and plan future steps (Stiggins, Arter, Chappuis, & Chappuis, 2004). The descriptive feedback provides targeted information about the right or wrong of the activities of the students than the evaluative feedback so this feedback supports the understanding of the activity/task of the students (Davies, 2003). In Turkish primary and secondary mathematics programs, students are asked to "give feedbacks to support their learning" (p.11) when constructing mathematics learning/teaching environments (see, MEB 2013). Results of the present study also showed that the value feedback was very positive for both the Grade 5 and the Grade 9 students.

The fifth component is *Learning Approach*: It focuses on the importance of discussion environments small or whole class discussions, to look for different possible answers or different ways to find the answer during mathematics learning. Group and collaborative learning environments such as small or whole class discussions pertain to creating and maintaining such highly social learning environments (Johnson, Johnson, & Smith, 1991). The results of the study by Dede (2013) support this view. Dede found that the underlying values of the Turkish teachers' decision making processes in group work could be categorized under three main headings: productivity, socialization, and flexibility/authority. Findings of the current study indicated that the Grade 5 and the Grade 9 students valuing of the learning approach was very positive. Similar findings were also found in the study carried out by Dede and Yaman (2006). They study's outcomes revealed that group work was preferred more than individual learning by Grade 6, 7, and 8 Turkish mathematics students.

Similarly, Turkish contemporary primary and secondary mathematics programs emphasize that the use of positive approaches in the process of mathematics learning and teaching, such as cooperation and solidarity, should be adopted (MEB, 2018a, 2018b). However, studies with different outcomes regarding group work in the Turkish education literature have also been reported. For example, Dede (2010) found that Grade 6, 7, and 8 students perceived that small group instruction was not valued highly

by mathematics teachers. In another study Dede (2006) reported similar results. The utility of small group instruction however, directly influences long-term retention of mathematical concepts (Urion & Davidson, 1992), improves students' mathematics achievement (Springer, Stanne, & Donovan, 1999), and maximizes students' interest towards mathematics (Davidson, 1971).

Finally, the sixth component is *Consolidating*. This component focuses on *consolidating* during mathematics learning, such as using concrete materials to understand mathematics and hands on activities. Results of the current study indicated that the valuing of consolidating in mathematics was very positive for Grade 5 students while positive for Grade 9 students. Turkish primary mathematics school programs also emphasize that "students should be asked to make comparisons between concepts and rules and to solve problems that can make connections between concrete and abstract representations" (MEB, 2005). Dede (2007), determined that Turkish students in Grades 6-8 use their teaching materials "once or twice a month" while high school students use "one or two times during the semester" in mathematics learning. Similarly, the results of the Dede (2005; 2006) studies with Turkish primary school mathematics teachers also showed that the teachers use very little teaching materials such as recording devices, slides, worksheets, training tapes, educational films and cartoons in their lessons while they use too much writing on their classroom boards, auxiliary resources, textbooks, and photocopying machines. Teaching materials such as, concrete materials to understand mathematics and hands on activities, influence what learners will learn and how teachers will teach (Maclellan, 1997).

The present study has demonstrated how survey data on students' valuing can be further interrogated and analysed quantitatively to explore the influence of grade level on Turkish students' mathematics learning values. The WIFI questionnaire enables us to conduct studies with large samples, and analyse and interpret the collected quantitative data statistically so that meaningful cross-cultural comparisons are possible. Being able to use the valuing discourses to explain observed differences between groups of students, opens up other fronts of possibilities of addressing these differences, in terms of values modification, negotiation, and alignment. Mathematics educators could use the findings to enrich their understanding of what their students' values in mathematics learning, and to use this knowledge to better plan and deliver mathematics teaching experiences in school.

Students learn more effectively in environments, which align with their preferences. These preferences vary with year level and as it has been shown in this study, students in different grades demonstrate various levels of valuing in their mathematics learning. What is valued in a certain community is not necessarily valued in another. It is important for teachers to be aware of such differences and to plan their lessons in ways where there is shared valuing of mathematics and its pedagogy between teachers and students. As mentioned above, previous studies with Turkish students have indicated that there were disparities between students' and teachers' values. Further research is required in this area. Future research should be conducted investigating the reasons why Turkish mathematics teachers are not teaching in accordance with principles mandated by the MEB.

Acknowledgements

The study involving students from Turkey was supported, in part, by grants from the Scientific and Technological Research Council of Turkey (TUBITAK, Grant No: 1059B191401095). Any opinions expressed herein are those of the authors and do not necessarily represent the views of TUBITAK. Special thanks to Prof. Dr. Uwe Gellert, Free University of Berlin, Germany.

References

Andersson, A., & Österling, L. (2014). Metric equivalence in international surveys: Cultural edges. In P. Liljedahl, C. Nicol, S. Oesterle, & D. Allan (Eds.). *Proceedings of the Joint Meeting of International Group for the Psychology of Mathematics Education (PME) and PME-North America* (vol. 1). Vancouver, Canada: PME.

Atweh, B. (2007, November). *Pedagogy for socially response-able mathematics education*. Paper presented at the annual conference of the Australian Association of Research in Education. Fremantle, West Australia.

Atweh, B., & Seah, W. T. (2008). *Theorizing values and their study in mathematics education.* Paper presented at the Australian Association for Research in Education Conference, Fremantle, Australia.

Baday Yıldız, E., Sivri, U., & Berber, M. (2012). Socio-economic development ranking of provinces in Turkey (2010). *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi* 39, 147-167

Bishop, A. J. (1988). *Mathematical enculturation: A cultural perspective on mathematics education*. Dordrecht, Netherlands: Kluwer Academic.

Bishop, A. J. (1996, June). How should mathematics teaching in modern societies relate to cultural values some preliminary questions. *Paper presented at the Seventh Southeast Asian Conference on Mathematics Education*, Hanoi, Vietnam.

Bishop, A. J. (1998). Culture, values and assessment in mathematics. In H. S. Park, Y. H. Choe, H. Shin, & S. H. Kim (Eds.), *Proceedings of the ICMI-East Asia Regional Conference on Mathematics Education* (vol. 1, pp. 27-37). Seoul, Korea: Korea Society of Mathematical Education.

Bishop, A. J. (2016). Can values awareness help teachers and parents transition preschool learners into mathematics learning? In T. Meaney, T. Lange, A. Wernberg, O. Helenius, & M. L. Johansson (Eds.), *Mathematics Education in the Early Years-Results from the POEM conference 2014*. Cham, Switzerland: Springer.

Bond, M. H. (1996). Chinese value. In M. H. Bond (Ed.), *The handbook of Chinese psychology* (pp. 208-226). Hong Kong: Oxford University.

Cai, J., Perry, B., Wong, N. & Wang, T. (2009). What is effective teaching: A study of experienced mathematics teachers from Australia, the Chinese mainland, Hong Kong-China, and the United States, In J. Cai, G. Kaiser, B. Perry, and N. Wong (Eds.), *Effective Mathematics Teaching from Teachers' Perspectives* (pp. 1-36) Rotterdam: Sense.

Chin, C., & Lin, F.-L. (2001). Value-loaded activities in mathematics classroom. In M. van den Heuvel-Panhuizen (Ed.), *Proceedings of the 25th Conference of the International Group for the Psychology of Mathematics Education (PME 25)* (vol. 2, pp. 249–256), Utrecht: Utrecht University

Clarkson, P., FitzSimons, G, Bishop, A., & Seah, W. T. (2000, December). Methodology challenges and constraints in the values and mathematics project. *Paper Presented at the Annual Meeting of the Australian Association for Research in Education*, Sydney, Australia.

Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education*, London: Routledge Falmer.

Correa, C., Perry, M., Sims, L., Miller, K., & Fang, G. (2008). Connected and culturally embedded beliefs: Chinese and US teachers talk about how their students best learn mathematics. *Teaching and Teacher Education, 24(1), 140-153.*

Council of Higher Education of Turkey (YÖK) (2017). *Statement on CoHE's Decisions Taken on November 9, 2017 at CoHE General Assembly Meeting Regarding Higher Education Institutions Examination***.** Retrieved December 02, 2017 from http://www.yok.gov.tr/en/web/cohe/detailnews.

Çabakçor, B. Ö., Akşan, E., Öztürk, T., & Çimer, S. O. (2011). Types of feedback that were received and preferred by prospective primary mathematics teachers. *Turkish Journal of Computer and Mathematics Education, 2*(1), 46-68.

Çetinkaya, G., & Kögce, D. (2014). An evaluation of secondary school Turkish and mathematics teachers' verbal feedback to students. *Turkish Journal of Social Work Research*, *18*(2), 113-136.

Davidson, N. A. (1971). *The small group-discovery method of mathematics instruction as applied in calculus* (Technical Report No. 168). Eric Document Reproduction Service. ED162879.

Davies, P. (2003). Closing the communications loop on the computerized peer-assessment of essays. *Association for Learning Technology Journal, 11*(1), 41-54.

Dede, Y. (2005, September). The views of primary mathematics teachers about the usage and value of ınstructional materials. *Paper presented at the XIV. National Conference on Educational Sciences* (poster presentation). Pamukkale University, Education Faculty. Denizli, Turkey.

Dede, Y. (2006, April). Assessing mathematics teachers' instructional activities. Paper presented at the *1st National Congress of Primary Teachers*, Gazi Education Faculty, Gazi University. Ankara, Turkey.

Dede. Y. (2007). Students' ideas about teaching styles of mathematics. *Abant İzzet Baysal University, Journal of Faculty of Education, 7(2*), 17-30.

Dede, Y. (2010). Turkish students' perceptions regarding their mathematics teachers' classroom practices. *US-China Education Review*, *7*(12), 10 -17.

Dede, Y. (2011). Mathematics education values questionnaire for Turkish preservice mathematics teachers: Design, validation, and results. *International Journal of Science and Mathematics Education, 9*(3), 603-626.

Dede, Y. (2012). Students' attitudes towards geometry: A cross-sectional study. *International Journal for Studies in Mathematics Education- IJSME, 5*(1), 85-113.

Dede, Y. (2013). Examining the underlying values of Turkish and German mathematics teachers' decision making processes in group studies. *Educational Sciences: Theory & Practice*, *13*(1), 670-706.

Dede, Y., & Yaman, S. (2006). Science and mathematics learning preferences of primary school students. *International Journal of Environmental and Science Education* (*IJESE), 1*(2), 172-180.

Ding, R., & Wong, N. Y. (2012). The learning environment in the Chinese mathematics classroom. In Y. Li & R. Huang (Eds.), *How Chinese teach mathematics and improve teaching* (pp. 150-164). New York, NY: Routledge.

Ernest, P. (1998). Images of mathematics, values, and gender: a philosophical perspective. In C. Keitel, (Ed.). *Social justice and mathematics education: proceedings of the 25th Conference of the International Group for the Psychology of Mathematics Education* (pp.45-58). Utrecht, Netherlands: Springer.

Earl, L. (2003). *Assessment as learning: Using classroom assessment to maximize student learning*. Thousand Qaks, CA: Corwin.

Fan, X. (2001). Statistical significance and effect size in education research: Two sides of a coin. *Journal of Educational Research, 94*(5), 275–282.

FitzSimons, G., Seah, W. T., Bishop, A., & Clarkson, P. C. (2001). Beyond numeracy: Values in the mathematics classroom. In J. Bobis, B. Perry, & M. Mitchelmore (Eds.), Numeracy and beyond. *Proceedings of the twenty-fourth Annual Conference of the Mathematics Education Research Group of Australasia* (pp. 202–209). Sydney: MERGA.

Goldin, G. A. (2002). Affect, meta-affect, and mathematical belief structures, In G. Leder, E. Pehkonen, & G. Törner (Eds.), *Beliefs: A hidden variable in mathematics education?* (pp. 59-72). Kluwer, Dordrecht.

Harecker, G. (2012). Teaching values at school: A way to reach a better understanding in our world. Paper presented in *Conference Proceedings New perspectives in Science Education*, Florence, Italy: Pixel.

Harkness, J. A., Villar, A., & Edwards, B. (2010). Translation, adaptation and design. In J.A. Harkness, M. Braun, B. Edwards, T. P. Johnson, L. Lyberg, P. P. Mohler, B. E. Pennell, & T. W. Smith (Eds), *Survey methods in multinational, multiregional and multicultural contexts* (pp. 117-139), Hoboken, NJ: Wiley.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81–112.

Hofstede, G. (2009). *Geert Hofstede's cultural dimensions*. Retrieved November 25, 2011 from http://www.geert-hofstede.com/hofstede_germany.shtml

Johnson, D. W., Johnson, R. T., & Smith, K. A. (1991). *Cooperative learning: Increasing college faculty instructional productivity.* ASHE-FRIC Higher Education Report No. 4. Washington, D.C.: School of Education and Human Development, George Washington University.

Koballa, T. R., & Glynn, S. M. (2007). Attitudinal and motivational constructs in science learning. In S. K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 75–102). Mahwah: Lawrence Erlbaum.

Kothari, C. R. (2004). *Research Methodology Methods & Techniques.* Second Revised Edition. New Delhi: New Age.

Leder, G., & Forgasz, H. J. (2006). Affect and mathematics education. In A. Gutiérrez & P. Boero (Eds.), *Handbook of research on the psychology of mathematics education: Past, present and future* (pp. 403-427). Rotterdam: Sense.

Maclellan, E. (1997). The role of concrete materials in constructing mathematical meaning. *Education 3-13, 25*(3), 31-35.

Ministry of National Education of Turkey (MEB) (2003). *The third international mathematics and science study (TIMSS, 1999)*. National Report I, Ankara: Author.

Ministry of National Education of Turkey (MEB) (2005). *Primary school mathematics curriculum (6-8. Grades)*, Ankara: Author.

Ministry of National Education of Turkey (MEB) (2007). *PISA 2006, International Student Evaluation Program, National PreReport*. Ankara: Author.

Ministry of National Education of Turkey (MEB) (2013). *PISA 2012, National PreReport*. Ankara: Author.

Ministry of National Education of Turkey (MEB) (2016). *PISA 2016, National Report*. Ankara: Author.

Ministry of National Education of Turkey (MEB) (2018a). *Mathematic curriculum (Primary and middle 1,2,3,4,5,6,7, and 8. grades)*. Ankara: Author.

Ministry of National Education of Turkey (MEB) (2018b). *High school mathematics curriculum (9, 10, 11, and 12. grades)*. Ankara: Author.

Pallant, J. (2007). *SPSS survival manual*. New York: McGraw Hill.

Randolph, A. P. (2007). Mathematics teachers' beliefs and affect. Lester. F. K (Ed.). *Second Handbook of Research on Mathematics Teaching and Learning* (pp. 257-318). Charlotte: NC.

Raths, L. E., Harmin, M., & Simon, S. B. (1987). Selections from values and teaching. In P.F. Carbone (Ed.), *Value theory and education* (pp.198-214). Malabar: Krieger.

Rokeach, M. (1972). *Beliefs, attitudes, and values: A theory of organization*. San Francisco: Jossey-Bass.

Seah, W. T. (2002). Exploring teacher clarification of values relating to mathematics education. In C. Vale, J. Roumeliotis, & J. Horwood (Eds.), *Valuing Mathematics in Society* (pp. 93–104). Brunswick, Australia: Mathematical Association of Victoria.

Seah, W. T. (2013). Assessing values in mathematics education. *Proceedings of the 37th conference of the international group for the psychology of mathematics education*, (vol 3, pp. 193-201). Kiel: PME

Seah, W. T., & Andersson, A. (2015). Valuing diversity in mathematics pedagogy through the volitional nature and alignment of values. In A. Bishop, T. Barkatsas, & H. Tan (Eds.). *Diversity in mathematics education: Towards inclusive practices* (pp. 167-184) Switzerland: Springer.

Seah, W. T., & Bishop, A.J. (2002). Values, mathematics and society: Making the connections, In C. Vale, J. Roumeliotis, & J. Horwood (Eds.), *Valuing Mathematics in Society* (pp. 105-113).Brunswick, Australia: Mathematical Association of Victoria.

Seah, W. T., Andersson, A., Bishop, A., & Clarkson, P. (2016). What would the mathematics curriculum look like if values were the focus? *For the Learning of Mathematics, 36*(1), 14-20.

Springer, L., Stanne, M. E., & Donovan, S. S. (1999). Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis. *Review of Educational Research, 69*(1), 21-51.

Stiggins, R. J., Arter, J. A., Chappuis, J., & Chappuis, S. (2004). *Classroom assessment for student learning: Doing it right-using it well*. Princeton, NJ: Educational Testing Service.

Swadener, M., & Soedjadi, R. (1988). Values, mathematics education and the task of developing pupils' personalities: An Indonesian perspective. *Educational Studies in Mathematics, 19*(2), 193-208.

The Organization for Economic Cooperation and Development (OECD) (2002). *Sample tasks from the PISA 2000 assessment*. OECD Publications, Paris.

Urion, D. K., & Davidson, N. A. (1992). Student achievement in small-group instruction versus teacher-centered instruction in mathematics. *Primus, 2*(3), 257-264.

Wong, N. Y. (1993). The psychosocial environment in the Hong Kong mathematics classroom. *Journal of Mathematical Behavior*, *12*(3), 303–309.

Wong, N. Y. (2003). The influence of technology on the mathematics curriculum. In A. J. Bishop, M. A. Clements, C. Keitel, & J. Kilpatrick (Eds.), *Second international handbook of mathematics education* (vol. 1, pp. 271-321). Dordrecht, The Netherlands: Kluwer.

Wong, N. Y., Han, J. W., & Lee, P. Y. (2004). The mathematics curriculum: Towards globalisation or Westernisation? In L. Fan, N. Y. Wong, J. Cai, & S. Li (Eds.), *How Chinese learn mathematics: Perspectives from insiders* (pp. 27-70). Singapore: World Scientific.

Yıldırım, I. (2008). Family variables influencing test anxiety of students preparing for the university entrance examination. *Eurasian Journal of Educational Research, 31*, 171-186.

Zhang, Q., Barkatsas, T., Law, H. Y., Leu, Y. C., & Seah, W. T. (2016). What primary students in the Chinese Mainland, Hong Kong and Taiwan value in mathematics learning: A comparative analysis. *International Journal of Science and Mathematics Education, 14*(5), 907–924.

Journal of Theoretical Educational Science, 12(4), 1164-1192, October 2019
Kuramsal Eğitimbilim Dergisi, 12(4), 1164-1192, Ekim 2019
[Online]: https://dergipark.org.tr/akukeg
DOI number: http://dx.doi.org/10.30831/akukeg.409775

Investigation of the Effects of Arduino-Supported Analytical Chemistry Experiments on Pre-Service Teachers' Self-Efficacy toward Information Technologies*

Arduino Destekli Analitik Kimya Deneylerinin Öğretmen Adaylarının Bilişim Teknolojileri Öz-Yeterliğine Etkilerinin İncelenmesi

Suat TÜRKOGUZ** **Fatma (SEFER) KAHRAMAN*****

Received: 26 March 2018 **Research Article** **Accepted:** 07 May 2019

ABSTRACT: Arduino is a tool which the data taken from sensors can be used. Temperature, humidity, distance, light, color and acceleration can be measured by Arduino connected sensors. It is aimed to determine the effects of analytical chemistry experiments supported by Arduino on pre-service teachers' self-efficacy toward information technologies. Participants of this study are 61 pre-service teachers. There are one experimental group (n_{EG}:34) and the other control group (n_{CG}:31) with random assignment method. In this study, "pre-test-post-test control group semi-experimental research design" has been adopted. In the experimental group, closed-ended experiments supported by Arduino were used. In the control group, closed-end experiments not supported Arduino were used. In both groups, confirmatory approach based experiment design was adopted. In order to measure self-efficacy perceptions of information technologies, "Information Technologies Self-efficacy Perception Scale for Pre-service Teachers (ITSPS)" was used. According to the results of the study, it was determined that the analytical chemistry experiments supported by Arduino has effects on their technology self-efficacy in a positive way. Arduino should be assessed on students' self-efficacy by testing in different chemistry-related trials. In addition, easier application of Arduino should be investigated.

Keywords: arduino, chemistry, self-efficacy, technology.

ÖZ: Arduino, sensörlerden alınan verileri kullanılabilen bir araçtır. Arduino'ya bağlı sensörler ile sıcaklık, nem, mesafe, ışık, renk ve ivme ölçülebilir. Bu çalışmada, Arduino destekli analitik kimya deneylerinin öğretmen adaylarının bilgi teknolojilerine olan öz yeterlikleri üzerindeki etkilerinin belirlenmesi amaçlanmıştır. Bu araştırmanın katılımcıları 61 öğretmen adayıdır. Bir deney grubu (n_{DG}: 34) ve bir kontrol grubu (n_{KG}: 31) rastgele atamayla oluşturulmuştur. Bu çalışmada "ön test-son test kontrol gruplu yarı deneysel araştırma deseni" kullanılmıştır. Deney grubunda Arduino destekli kapalı uçlu deneyler, kontrol grubunda ise Arduino'yu desteklemeyen kapalı uçlu deneyler yapılmıştır. Her iki grupta da doğrulayıcı yaklaşıma dayalı deney tasarımı benimsenmiştir. Katılımcıların bilgi teknolojilerinin öz yeterlik algılarını ölçmek için "Öğretmen Adayları İçin Bilgi Teknolojileri Öz Yeterlik Algılama Ölçeği" (BTÖYAÖ) kullanılmıştır. Araştırmanın sonuçlarına göre, Arduino destekli analitik kimya deneylerinin, teknolojinin öz yeterlik üzerinde olumlu bir etkisi olduğu tespit edilmiştir. Arduino, kimya ile ilgili farklı denemelerde test edilerek öğrencilerin öz yeterliliği konusunda değerlendirilmelidir. Ek olarak, Arduino'nun daha kolay uygulanması araştırılmalıdır.

Keywords: arduino, kimya, öz yeterlik, teknoloji.

* This study was a part of master science dissertation titled "The Effects of Chemistry Experiments Designed with Microprocessor Interface on Pre-Service Teachers' Technology and Chemistry Self-Efficacy". Also, this study was presented "IV. International Eurasian Educational Research Congress" in Pamukkale University (Denizli) on May 11-14, 2017.

** *Corresponding Author*: Assoc. Prof. Dr., Dokuz Eylül University, İzmir, Turkey, suat.turkoguz@gmail.com, https://orcid.org/0000-0002-7850-2305

*** Graduate Student, Dokuz Eylül University, İzmir, Turkey, seferfatma@hotmail.com, https://orcid.org/0000-0001-8945-6343

Citation Information
Türkoguz, S., & Sefer, F. (2019). Investigation of the effects of Arduino-supported analytical chemistry experiments on pre-service teachers' self-efficacy toward information technologies. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 12*(4), 1164-1192.

ISSN: 1308-1659

Introduction

One of the most basic needs for humanity throughout history is to reach knowledge. With the advent of new information reached by scientific studies, science and technology are expanding accordingly. In this context, the influence of technology in recent years has manifested itself in all areas of life. Technology can be described as all of the tools, methods and applications for the different fields of the industry. In other words, a design process arising from need is a process (Uluğ, 2000). Technology makes people's lives easier, and it also makes it easier to access the information in a shorter time.

It is possible to see technological applications in every point where difficult conditions are eliminated and daily life is facilitated. Technology is a process in which systems are developed in line with people's desires and needs. Technology offers significant opportunities in the development of scientific thinking skills. For this reason, the use of technology should be included frequently in the education process. Information technologies included in the training process make it easier to acquire, analyze and present the data; it also supports the active participation of students in the research process. At the same time, the teacher better manages the teaching techniques and makes it easier to record (Milli Eğitim Bakanlığı [MEB], 2006). Kesercioğlu, Balım, Ceylan, and Moralı (2001) found that integrating technology into science is very important for effective science education. In this context, the necessity of using effective technology in science education is emphasized (Yenice, 2003). Science requires an experiment-based education because it contains so many abstract concepts. Otherwise, students will not be able to conceptualize physical, chemical and biological events. As a result, science courses cannot go beyond instantaneous knowledge transfer. The main purpose is to construct and understand the information presented in the lessons. Given the fact that primary and middle school students are having problems in perceiving abstract expressions, the use of technology is important for the realization of these abstract information (Akpınar, Aktamış, & Ergin, 2005; Çakmak, 1999).

How can technology be used in schools or different learning environments, especially in the science courses? Microcontrollers such as Arduino are very convenient tools in science and it can be used in different applications of the science with the integration of technology. When the researches in the field literature are examined, it is seen that there are different investigations with the Arduino processor. Arduino is a very convenient interface for producing different projects. For this reason, Arduino is one of many technological materials that can be used for an effective training process and learning environment. Arduino is a processor that can integrate sensors. With Arduino, a large number of experiments and projects can be tried in different areas (Arduino, 2014). Because Arduino offers multiple sensors, many different experiments can be performed with a single Arduino circuit. Because the Arduino cycle is easy to use and cost, it can be easily used in science education. In this context, this device is very economical for schools and it is also easy to buy. Considering the studies which has been done, it is implied that there are many comprehensive and different studies that can be conducted with the Arduino m. As the importance and necessity of technology integration becomes clear, research on the integration of technology will increase. In a study which was conducted by Süzen, Ceylan, Çetin, and Ulusoy (2017), a robot is modeled on the X-Y plane using Arduino development card. A software named "Digital

Painter" which transmits data via Bluetooth to this robot has been developed. The image to be drawn is first loaded into the computer software called "Digital Painter" and then transferred to the Arduino circuit via Bluetooth. In order to be able to draw the robot, it is necessary to fix it to the Arduino circuit. Thus, the image data from the card is drawn on the desired floor. Another example study is carried out by Walkowiak and Nehring (2016), an easy-to-use digital data collector "ChemDuino" was designed for the classroom environment. ChemDuino (*Chemistry-Arduino*) is the use of the Arduino hardware and software application to improve chemistry teaching and learning. In this study, it is demonstrated how Excel PLX DAQ can be used in visualizing the data collection process using ChemDuino. In this process, the relationships among sensors such as temperature, conductivity, and pH have been realized using different sensors. In addition, real-time data collection presentations are visualized with media tools such as smart boards. Thus, it is stated that real-time measurements can be easily applied to classes where chemistry topics are taught. This research allowed the recording and graphing of data on pH change due to temperature increase by combining pH and temperature devices in neutralization reactions. Similar studies of this research can be reproduced.

The fact that the integration of Arduino technology into education is important and it is necessary. The number of studies conducted in the educational literature increased consistently. The number of publications related to Arduino has been increasing especially with papers presented in Engineering Conferences from 2009 to 2016. Ardunio was the most preferred microcontroller in engineering education for the last 5 years. Also, the number of publications containing the Arduino platform has increased significantly over the years because Arduino has increasingly become popular among academicians. In these publications, how the Arduino was used in education (primary schools, high schools and universities) and suggestions were made for its use in schools were stated (El-Abd, 2017). Nowadays, recommendations on the necessity of integrating Arduino into educational environments has been becoming widespread (Numanoğlu & Keser, 2017). 90% of the teachers have the opinion that the usage of Arduino activities is important (Çengel, Alkan, & Çayır, 2018). In our country, programming and coding training has started since 2012 in the 5th grade (Pala & Mıhcı-Türker, 2019) and the usage of technologies such as Arduino have been increased in terms of robotic applications so as to be presented in national and international competitions in schools however, the usage is not enough in our country. Inadequate school infrastructure and lack of knowledge of teachers can be inferred as the reason for not using this adequately (Çengel, Alkan, & Çayır, 2018). The vast majority of teachers do not regard themselves competent in coding or just consider it basic enough. This may be caused by lack of courses in undergraduate education. Through researches, it was stated that there were some problems in programming education (Arabacıoğlu, Bülbül, & Filiz, 2007; Esteves & Mendes, 2004; Gomes & Mendes, 2007; Mıhcı-Türker & Pala, 2018; Ozoran, Çağıltay, & Topalli, 2012; Saygıner & Tüzün, 2017b). Most of the teachers do not take any training on coding, robotics coding and 3D design for middle school students and in their university years and subsequent professions (Çengel, Alkan, & Çayır, 2018). The integration of Arduino technology into education can be carried out on specific academic researches with the education of teacher and pre-service teachers

primarily within the scope of specific cognitive and affective objectives with appropriate learning approaches.

In researches carried out with different research designs, technology-supported teaching environments such as Robotics and Arduino positively affect the attitudes, interests, motivations and skills of the students both in cognitive and affective dimensions (Buluş Kırıkkaya & Başaran, 2019). For example, it has been observed that students' attitudes towards information communication technologies have increased in technology-supported physics laboratory (Arakliotis, Nikolos, & Kalligeros, 2016; Buluş Kırıkkaya & Başaran, 2019; Çömek & Avcı, 2016; Günbatar & Karalar, 2018; Merino, Ruiz, Fernandez, & Gil, 2016; Numanoğlu & Keser, 2017; Oluk & Korkmaz, 2018; Sohn, 2014). In addition to that, Sáez-López, Román-González and Vázquez-Cano (2016) investigated the use of Scratch between the 5th and 6th grades in Spain and found that high and positive attitudes and motivation emerged due to the use of Scratch. According to the interviews with the teachers, it was understood that there was an increase in the interest of the students with the educational robot applications and the skills of programming, problem solving and creativity. In addition, it was stated that it provided the students guidance on technology-related interest and career choice (Oluk & Korkmaz, 2018). It has been observed that scientific process skills and academic achievements have been developed in science courses conducted with robotic activities and with arduino supported activities (Çömek & Avcı, 2016). Numanoğlu and Keser (2017) have found that students can think more creatively in addition to their attitude and skill development. Attitudes and problem solving skills were examined in the studies conducted according to experimental design with control and experimental groups. It was concluded that there was a significant difference in attitude and problem solving skills of the students who applied with Arduino (Sohn, 2014). Analyzing some researches that relate problem solving and programming, it is stated that programming education contributes to the development of problem solving skills in students. It is the development of logical thinking skills in students as the reason for giving programming education in Europe. In the literature, computer programming education is emphasized to contribute to the development of this ability (Mains, 1997; Saygıner & Tüzün, 2017a; Sebetci & Aksu, 2014; Swain, 2013). It is concluded from the study examples that programming and coding trainings contribute significantly to the cognitive and affective characteristics of students. According to the related studies, it is understood that there are exemplary activities for science education and these activities have positive effects on attitude, success, motivation and skills. However, there is an uncertainty for self-efficacy, which is an affective variable while achieving positive progress in achievements such as attitude achievement, motivation and skill in the teaching of science education gains and it is supported by technologies such as robotics and arduino.

The findings of programming and coding studies showed that teachers 'and students' self-efficacy perception scores related to programming affect the performance of programming (Altun & Mazman, 2013; Aşkar & Davenport, 2009; Davidson, Larzon, & Ljunggren, 2010; Kasalak, 2017; Ramalingam, LaBelle, & Wiedenbeck, 2004). In a study, mBLock developed self-efficacy perceptions of secondary school students in the program teaching (Günbatar & Karalar, 2018). It has been proven that technologies such as Arduino provide support to educators who develop engineers in

engineering faculties and improved their self-efficacy (Mallik & Rajguru, 2018). Yükseltürk and Altıok (2017) analyzed the effects of Scratch programming on pre-service teachers' views on computer programming. It was also concluded that participants generally had higher and more positive self-efficacy perceptions and attitudes. The fact that the self-efficacy of the teachers who participated in the education of information technologies is higher than the ones who did not attend the training, and it shows that the trainings on this subject have a positive effect on the self-efficacy of the teachers. In this respect, it is important to give trainings to teachers in order to increase their self-efficacy. Giving seminars to science teachers such as STEM and arduino can contribute to the literature (Görgülü & Küçükali, 2013). It is stated that because of their low self-efficacy perceptions in order to develop self-efficacy in students and teachers who do not have any experience in Arduino, the fact that the content has been designed from simple to complex in a way that does not reduce the motivation from the beginning will have a positive effect on shaping their self-efficacy perception (Altun & Mazman, 2013). Yükseltürk and Altıok (2016) analyzed the effects of programming with Scratch on the attitudes of Information Technologies pre-service teachers for programming. As a result, it was stated that Scratch platform had a significant positive effect on Information Technologies pre-service teachers' self-efficacy perceptions and attitudes. Based on their findings, it was recommended to redesign the programming trainings using Scratch in order to increase the logical computational skills and creative thinking skills of the beginner programmers (Kasalak, 2017). It is understood that the results obtained from different research patterns with different sample groups have a positive effect on the self-efficacy of the participants. However, in these researches, robotic coding and programming were applied in educational environments that are not related to the concepts of science education. The majority of the sample consisted of students studying in Engineering and Computer Technology pre-service Teachers. No teaching content was found in the development of the concepts of science to improve the self-efficacy of the participants and especially in the development of the concepts of chemistry. Therefore, the use of arduino-assisted teaching content in the analytical chemistry laboratory is essential in this study.

For the active use of technologies like Arduino, the teachers who are the main parts of education must have knowledge about this subject. Teachers can help their students use this technology as long as they know how to use this device efficiently. This can be achieved by increasing teachers' self-efficacy beliefs about the use of information technology. Self-efficacy is the subjective judgment of whether an individual has the necessary skills to perform a job (Bandura, 1997; Gawith, 1995; Zimmerman, 1995). In studies conducted on this field, it is seen that individuals with high self-efficacy beliefs about the use of technology are more desirous of implementing the activities using technology (Usluel & Seferoğlu, 2003). Teachers need to feel that they are competent enough to use technology in order to actively use technology. They cannot effectively use it when they think they are insufficient (Geer, White, & Barr, 1998). For this reason, it is very important for teachers to have a high self-efficacy belief in technology use. Otherwise, they tend to avoid using technology in their lessons. Teachers with a high self-efficacy belief in the use of technology have no difficulty in incorporating technological devices into the teaching process and offer their students a more productive learning environment. For this reason, it is important to

determine the self-efficacy beliefs of teachers and pre-service teachers for the use of information technology.

The use of the Arduino as an educational tool may be challenging. Studies have shown that the students who use Arduino for the first time find it not as easy as expected and have difficulty in developing applications. Furthermore, in some cases, students have judged that programming with Arduino cannot be taught. Arslan also stated that the widespread use of Arduino and the reality of availability on almost all subjects could prevent students from creating original studies (Arslan, 2018). Arduino related mechanical and physics project sharing is quite high. Chemistry and other areas remain in the minority. Therefore, Arslan's concern can be reduced by arduino studies in the field of chemistry.

It can be said that academic studies on the use of these technologies in engineering are very high, but academic studies in the field of science education have not reached a sufficient level. In particular, there is a need for experimental studies examining the effect of the use of robotic and arduino supported studies in science courses on student achievement, attitude and motivation (Çömek & Avcı, 2016). For this reason, it is rare to do experimental researchs or correlational researchs of Arduino in science education studies. The variables such as attitude, motivation, skill and self-efficacy are examined in different sample sizes in the academic researches which are mostly under the robotic and program coding studies. It can be said that the experimental researches on arduino and robotic coding are not sufficient. Science teachers are the educators who have enough education to perform interdisciplinary activities. Therefore, science teachers are the most competent individuals after the engineers to perform robotic technologies and Arduino supported applications. Especially in the field of electrical and mechanical applications, the robotic and Arduino studies can be applied in the classes of science teachers with an interdisciplinary approach (Kasalak, 2017).The spread of the educations supported by Robotics and arduino throughout the country can only realized with skillful and competent science educators. Robotic and Arduino supported studies are important in determining the obstacles encountered during the application as well as researching the self-efficacy of STEM and Science educators. When the literature is analyzed briefly, Arduino supported studies can be tested in experimental studies; It can be used in researches of attitude, interest, motivation, skills and self-efficacy. Generally, in the related literature, success, attitude, and skill research are found mainly, while there is a minority in self-efficacy. There are very few studies on the effects of the use of arduino and chemistry on person's attitudes and behaviors. The Arduino installation scheme is more suitable for the application of mechanical and electrical issues therefore, the use of arduino has been more of a physics issue. Its' use in chemistry subjects is very rare. It is also important to examine the effects of the use of Arduino with chemistry subjects in the concepts of skill, attitude and self-efficacy. In this context, this study may contribute to the integration of two disciplines in the field of education. Teachers have significant responsibilities to enable students to use technology efficiently and consciously. First of all, teachers need to be able to adapt to technological developments and have a high self-efficacy belief. In this context, it is aimed to investigate the effect of Arduino-supported analytical chemistry experiments on the self-efficacy of science pre-service teachers for the use of information technology.

Problem Situation

Nowadays, science and technology are developing rapidly and therefore individuals who can adapt immediately to innovations are needed. Education plays an important role in integrating technology into everyday life. In line with the development of technology, most of the countries have introduced innovations in order to develop their education systems in recent years (Balay, 2004). In order to benefit from technology in education systems, teachers should be trained in a qualified manner. (Kirschhner & Selinger, 2003; Şemseddin & Odabaşı, 2004). Otherwise, there will be no efficient technology integration.

In addition to technology, individuals with high self-efficacy are needed to train qualified teachers. Teachers need to develop their self-efficacy beliefs in order to fulfill their professions properly. Self-efficacy are the judgments of individuals about the level of being able to perform the necessary actions in some situations they face. If individuals' judgments are positive, the individual plans his / her actions about the situation he / she encounters in a way that will succeed him / herself, and if the judgments are negative, he / she experiences anxiety (Koballa & Crawley, 1985). In this context, teachers should have high self-efficacy in order to create an effective educational environment.

One of the basic requirements for the development of a country is to support science and produce technology. From this point of view, the importance of science courses emerges. The foundation of science education begins in schools. Individuals adopt scientific thinking, questioning, analytical and creative thinking during this training. Therefore, it is necessary to give importance to science education in order to educate individuals who can investigate, question critically and analytically, solve problems creatively and always renew themselves. Science courses generally cover subjects that require practice. Science courses are not sufficiently taught with traditional teaching techniques. In recent years, according to the inquiry-based learning approach, science is taught by doing and teaching science. At this point, the necessity of education based on technology integration arises. Teachers should have a high level of self-efficacy regarding technology in the efficient implementation of this integration. Because individuals' self-efficacy beliefs and actions are in the same direction. Teachers with high self-efficacy beliefs are more active and enthusiastic during the use of technology.

The integration of technology into the course contents does not mean that the responsibility of the teacher is reduced. This situation has a positive effect on students' technology attitude. Teachers who use technology efficiently increase the motivation and interest of students and become a role model for them (Halis, 2002). Therefore, teachers' having high self-efficacy in using technology is essential in terms of reflecting this to their teaching environment. At this point, the importance of developing teachers' self-efficacy about chemistry and information technologies is emerging.

Importance of Study

Technology has an important role to play in advancing education. For this reason, teachers need to combine their working areas with technology (Akkoyunlu, 2002). The inclusion of technology in educational content is particularly necessary in terms of effective learning for some courses. There are many abstract concepts in

science courses such as physics, chemistry and biology; and therefore, technology should be used to teach meaningful concepts. Because technology helps to connect science subjects and daily life (Çepni, 2005). With technology abstract concepts can be made more concrete and meaningful learning can be achieved. In this respect, the use of information technologies in science education should be included.

One of the most important points of social development is qualified and efficient education; and the cornerstone of this is teachers. Because teachers are one of the most important factors that regulate the learning process and learning environment (Akkoyunlu & Kurbanoğlu, 2003). In accordance with the objectives of the curricula, science teachers and pre-service teachers' self-efficacy towards technology should be taken into account in order to integrate technological innovations with education.

There is a need for teachers who have a high self-efficacy perception for an efficient learning process and technology integration. Because self-efficacy is the judiciary of individuals about the successful and systematic conduct of actions (Bandura, 1997). In other words, self-efficacy is their personal opinion about whether individuals will be successful in their action. At this point, there is internal motivation. Individuals' beliefs in their capacities and abilities influence their success. Therefore, teachers who have high self-efficacy perception in technology will not have difficulty in integrating technological devices in the teaching process; and provide a more efficient learning environment for their students. Therefore, it is important to determine the self-efficacy perceptions of science teachers and pre-service science teachers.

When the self-efficacy perception studies related to technology are reviewed, it is seen that mostly computer self-efficacy perception is emphasized. In this research, interdisciplinary interaction is provided by integrating Arduino in the content of analytical chemistry course. In this research, it is expected to determine the effect of chemistry experiments designed with microprocessor interfaces (example Arduino) on the information technologies' self-efficacy of pre-service science teachers. It is thought that this research will contribute to the literature in the field of technology integration with Arduino use and accordingly the change in information technologies' self-efficacy.

Purpose of Study

Nowadays, technology is constantly developing with the developments in scientific field. Therefore, there is a need for individuals who interrogate, criticize and think analytically. At this point, schools play an important role. There is a need for educational environments that allow students to interact with technology. In line with the scientific developments, technology integration has become a necessity rather than a privilege (Çiçek, 2006). For this reason, education systems should be reorganized according to scientific and technological developments in order to contribute more to its purpose.

Technology integration in the process of education is also very important for students. Students use technology to play an active role in selecting, acquiring and showing competence in learning objectives. The International Society of Technology Education (ISTE) has set some standards for the use of technology. ISTE is a community established with the aim of increasing the success of the teaching process with the efficient use of technology. The standards for the use of technology in education for students are as follows (ISTE, 2016):

a) Students set personal learning goals; develop strategies using technology to obtain them; and think about the learning process to improve learning outcomes.

b) Students can set up networks and organize learning environments in a way that supports the learning process.

c) Students use technology to inform, develop, and receive feedback to demonstrate their learning in a variety of ways.

d) Students will be able to comprehend basic concepts of technology processes; demonstrate the ability to select, use and troubleshoot existing technologies; and transfer their knowledge to discover emerging technologies.

Teachers have important responsibilities for the students to use technology efficiently and consciously. First of all, teachers should be able to keep up with technological developments and have high self-efficacy perception. In this context, the main aim of the research is to determine the effects of analytical chemistry experiments designed by Arduino on the information technology self-efficacy of pre-service science teacher.

Problem statement

The problem statement of the research was determined as "Is there any effect of chemistry experiments designed with Arduino microcontroller interface on the information technologies self-efficacy of pre-service teachers?"

Assumptions

1. It is assumed that the participants did not participate in a study using this method before.
2. It was assumed that the experimental and control group students participated in the study gave a sincere response to the scales used for Data collection.
3. It was assumed that the participants were not involved in another study during the study period.

Scope and Limitations of the Study

1. The Study is limited to students of Science Education at Dokuz Eylül University, Buca Education Faculty.
2. The Study is limited to the 2016-2017 academic year fall semester.
3. The Study is limited to 2nd year students of Science Education.
4. The Study is limited to the course of Analytical Chemistry Course Laboratory.

Method

Design of Study

In this study, "pre-test-post-test control group semi-experimental research model" which is one of the experimental research models has been adopted (Büyüköztürk, 2008; Çepni, 2007; Kaptan, 1998, Karasar, 2004). In experimental studies, one or more control groups and test groups, which are generally considered to be equivalent, are used. In the research process, the applications used in the hypothesis testing in the experimental group and the existing applications in the control group.

Before and after the application, the tests are applied as pre-test and post-test. In this way, the effect of the applications used in the experimental group is investigated (Çepni, 2007).

This study was carried out in Dokuz Eylül University Buca Education Faculty Science Teacher Education Department. One of the second grades was assigned randomly as the experimental group and the other as the control group. Before and after the application, the tests were applied to the pre-service teachers in the experimental group and the control group as pre-test and post-test. In the experimental group, closed-end chemistry experiments with Arduino support based on confirmatory approach; in the control group, closed end experiments based on confirmatory approach were performed.

Dependent variables of study are self-efficacy towards technology of pre-service teachers. The independent variables that can influence the dependent variable are the activities used in the control and experimental groups. Disruptive variables were controlled by providing training to the control and experimental groups with parallel sessions from the same teacher.

Participants

The participants of this study were 61 pre-service teachers in the 2nd year of Science Education program at Dokuz Eylul University. In the undergraduate program of Science Education, Analytical Chemistry course is given as 2 theoretical courses and 2 applications in the 2nd year of the program. In the theoretical part of the course, common lessons are taught in the experimental and control groups; during the application of the course, activities and experiments were carried out with different methods in common acquisitions. In this study, Arduino microcontroller applications were developed only in accordance with the levels of pre-service science teacher. Fifty three of the pre-service science teachers are female, and eight are male. This distribution was 26 females and 6 males for the experimental group, and 27 females and 2 males for the control group. Details of the participants are given in Table 1. Since distributions of classes were limited to the first year students enrolled in their programs, existing classes were determined as experimental and control groups. Therefore, the distribution of the equivalent male population was not realized. One of the classes was chosen as the experimental group (*n*: 32) and the other as the control group (*n*: 29). This study was designed according to "pre-test-posttest control grouped semi-experimental research design" from the experimental research methods. Within the scope of Analytical Chemistry Laboratory course, pre-test and post-test post-tests were applied to the students in the experimental and control groups. In the experimental group, Arduino supported closed-end analytical chemistry experiments were conducted based on confirmatory approach; in the control group, closed-end experiments (without the support of information communication technologies) were conducted based on the confirmatory approach.

Table 1

Personal Characteristics of Participants

	Characteristics	Experimental Group f(%)	Control Group f(%)	All Situation f(%)
Gender	Female	26(%81.3)	27(%93.1)	53(%86.9)
	Male	6(%18.7)	2(%6.9)	8(%13.1)
Age	19 and below	2(%6.3)	1(%3.4)	3(%4.9)
	20	19(%59.4)	17(%58.6)	36(%59)
	21	9(%28.1)	7(%24.1)	16(%26.2)
	22 and up	2(%6.2)	4(%13.7)	6(%9.9)
Region	Mediterranean	1(%3.1)	2(%6.9)	3(%4.9)
	Eastern Anatolia	2(%6.3)	3(%10.3)	5(%8.2)
	Aegean	16(%50)	11(%37.9)	27(%44.3)
	Southeastern Anatolia	1(%3.1)	1(%3.4)	2(%3.3)
	Central Anatolia	3(%9.4)	4(%13.8)	7(%11.5)
	Black Sea	2(%6.3)	1(%3.4)	3(%4.9)
	Marmara	7(%21.9)	6(%20.7)	13(%21.3)
Mean Course	G. Chemistry I	48.8	41.8	45.5
	G. Chemistry II	37.5	38.0	37.8

Data Collection Tools

In order to measure the self-efficacy of pre-service teachers towards information technologies, "Information Technology Self-efficacy Perception Scale (ITSPS)" developed by Ekici, Ekici, and Kara (2012) was used. The self-efficacy scale is a 5-point Likert-type scale. The attitude items in the scale were rated as “Strongly Disagree”, “Disagree”, “Undecided”, “Agree” and “Strongly Agree”. In the validity and reliability studies, the draft scale consisting of 28 items was applied to 275 Science and Technology Teacher teachers in Denizli, Samsun, and Burdur. In item analysis, item-total correlation coefficient was removed from 1 scale item and factor analysis was performed to examine the construct validity. As a result of the explanatory factor analysis, the Cronbach-Alpha internal consistency coefficient of the final scale was found to be α=0.97. Common factor loadings of 27 items in the scale vary between “0.584” and “0.840”. At the end of the studies, a valid and reliable information technologies self-efficacy scale consisting of 27 items was developed for teachers and pre-service teachers. Within the scope of this study, Cronbach's α coefficient of ITSPS was calculated as 0.94. The reliability coefficient of a reliable Likert type scale should be as close to 1 as possible. According to these results, it can be said that the results to be reached from the scale are reliable.

Data Collection Process

1. Pre-service teachers participating in the study were randomly distributed to the experimental and control groups.

2. Both groups were pre-tested.
3. The participants in the experiment and control group were grouped into 5 groups to be suitable for the cooperative learning class. Experiments were carried out in weekly intervals, adhering to the instructions. Pre-service teachers were asked to write weekly test reports.
4. A weekly experiment with Arduino was carried out in the experiment group (see Appendix).

   Experiment 1-Anion-Cation Reaction in Salts (common with control group)

   Experiment 2-Chromatographic Analysis (common with control group)

   Experiment 3-Law of Lambert-Beer (Arduino) - (See Appendix, Example of experimental setup)

   Experiment 4-Viscosity (Arduino)

   Experiment 5-Chemical Equilibrium: Determination of Equilibrium Constant Kd (Arduino) - (See Appendix, Example Experiment Setup)

   Experiment 6-Acid-Base Titration: HCl Reaction with NaOH (Arduino)

   Experiment 7-Endothermic-Exothermic Reactions (Arduino)

   Experiment 8-Conductometric Chlorine Test (Arduino)
5. The participants in the control group performed the experiments suitable for the experiment gains in the experiment group without Arduino applications.

   Experiment 1-Anion-Cation Reaction in Salts (Common with Experiment Group)

   Experiment 2-Chromatographic Analysis (common with experimental group)

   Experiment 3-Lambert-Beer Law (without Arduino)

   Experiment 4-Viscosity (without Arduino)

   Experiment 5-Chemical Equilibrium: Determination of Equilibrium Constant Kd (without Arduino)

   Experiment 6-Acid-Base Titration: HCl Reaction with NaOH (without Arduino)

   Experiment 7-Endothermic-Exothermic Reactions (without Arduino)

   Experiment 8-Chlorine Test according to Mohr Method (without Arduino)
6. Last week, Post-test was performed on experimental and control groups.

Analysis of Data

The data were analyzed by SPSS 20 program. Descriptive statistics were used to determine the self-efficacy of teachers' information technologies.

In the process of analyzing the data collected to answer the research questions in this study; It was determined by using the Kolmogorov-Smirnov and Shapiro-Wilk normality test whether or not the parametric tests would be performed on the data obtained from the responses of the pre-service teachers to the information technologies self-efficacy scale (Razali & Wah, 2011; Ural & Kılıç, 2006). The normal distribution of the data and the homogeneity of the variances were examined by Kolmogorov-Smirnov, Shapiro-Wilk, Skewness, Kurtosis, and Levene tests, respectively. The value of p in the S-W tests was greater than .05, indicating that the scores did not differ significantly from the normal distribution and the distribution was normal

(Büyüköztürk, 2008). At the end of the study, it was decided that Mann Whitney U test, descriptive analysis and one-way ANCOVA were used to determine whether teachers' information technologies self-efficacy changed according to various variables. The data were evaluated at p=.05 significance level.

Internal Validity Threats and Precautions

In experimental research, it is possible that the result will be influenced by the threat factors arising from internal validity. The factors that threaten internal validity in experimental research: the duration of the study, the physiological and psychological development of the participants, the measurements done before the experimental practices, the use of different measurement tools, the stacking of the endpoint responders during the pretest / posttest application, the bias in the determination of the experimental / control groups, data loss (Baştürk 2009; Cook & Campell, 1979; Ercan & Kan, 2004; Fraenkel & Wallen, 2000). The threat of internal validity is related to the reality of the result obtained from the research and questions the deteriorating factors. Therefore, in the internal validity threat, "Is the result obtained from the research real?" and "What are the possible situations that change research results?" questions are asked. In this context, it is necessary to take necessary measures to identify and eliminate the threat elements that will affect the validity of the experimental design (Creswell, 2003).

Internal validity in experimental research means that the dependent variable is only affected by the independent variable and is only related to it. Internal validity is an indication of the fact that the change in the dependent variable is actually caused by the independent variable. Therefore, the researcher tries to control the factors that may affect the dependent variable except for the independent variable (Bal, 2019). One way to prevent the factors that threaten internal validity in experimental research designs can be by including the control group in the research design and by positioning it correctly (Karasar, 1998). Another factor that threatens internal validity is the determination of the experimental group and control groups by means of neutral assignment in the prevention of biased grouping. In addition, it is thought that the effect of maturation can also be controlled by the neutral assignment of the groups. Because, it is assumed that the effect of maturation through neutral assignment will occur equally in all experimental conditions (Aktaş, 2013; Buldur & Doğan, 2017). In this study, the classes of students in the experimental and control groups were not re-grouped since they were determined from the school enrollment period. Experimental and control groups have been formed by making neutral assignments to existing classes. In this study, although it is not a full experimental study, it is tried to provide internal validity by semi-experimental study. The study was carried out with pretest-posttest control grouped experimental design. Participant loss is another factor threatening internal validity. To eliminate this threat, experimental (n=32) and control (n=29) groups were formed and possible participatory losses were kept under control. In this study, data and participant loss was not experienced. In the other way to increase internal validity, validity and reliability measurement tools should be applied to all participants. The measurement instrument used in this study was first developed abroad. After Turkish adaptation, validity and reliability study was performed on a large sample. In this study, single measurement tool was distributed to both groups. No different measuring tools were used. In this way, it has been tried to prevent internal validity threat situations caused by

data collection tools. The measurement tool effect occurs when the measuring instruments differ in experimental conditions. This threat arises when the tests given to the participants are different, the tests are given by different people and the different observers do not evaluate objectively (Aktaş, 2013). In this study, the applications to the students in the experimental and control groups were performed on different days. In the laboratory environment of the students encounter each other is minimized. There was no data loss between pre-test and post-test. The students were fully involved in the practices. It is thought that students in the second year of university do not pose a threat to maturation. Students at this level have passed through the familiarization process and are in full effort to progress in their careers. A preliminary pilot application was not performed in this study. However, applications that could be used for pilot study were carried out. The first 5 weeks of the period were used in warm-up activities and the main applications were started in the sixth week. The instructor who carried out the applications had a 3-month trial period for the calibration and testing of the devices before the beginning of the semester. After experiments and activities were tried and the devices were calibrated, applications were made. In this study, the application days and hours of the tests in the experimental and control groups are the same. Both groups were trained in the same period. In this study, both groups were given the same instructor. The students in the experimental and control groups do not know each other and there is no material sharing. In this study, pre-tests were applied at the beginning of the fall semester and the final tests at the end of the fall semester. Therefore, it is thought that pre-tests do not have a guiding effect on the final tests.

Findings

In this section, findings of experiment and control groups are given. In the first study, the normal distribution and homogeneity of the data were examined to determine the suitability of study data for parametric tests. Normal distributions of data were evaluated for Kolmogorov Smirnov Normality Test, Shapiro-Wilks Normality Test, Skewness and Kurtosis values. In Kolmogorov Smirnov and Shapiro-Wilks's Normality Test, the table in SPSS is Assymp.Sig. (Significance) line is larger than 0.05, which is the limit value in the statistical significance calculations, the distributions of the examined variables are normal, whereas the values smaller than 0.05 indicate that they do not have normal distribution (Eymen, 2007). In addition, the values of Skewness and Kurtosis are also within the range (+1,-1), indicating that the data are normally distributed.

Table 2

Normal Distribution Analysis Results of ITSPS Data of Pre-Service Teachers in the Experiment and the Control Group

	Group	Kolmogorov-Smirnov			Shapiro-Wilk			Skewness	Kurtosis	Distribution
		F	*sd*	*p*	*F*	*sd*	*p*			
ITSPS Pre-test	CG	0.109	29	.200	0.981	29	.857	-0.387	0.729	Normal
	EG	0.148	32	.071	0.912	32	.013	-10.074	0.856	Normal*
ITSPS Post-test	CG	0.134	29	.192	0.959	29	.307	-0.417	-0.563	Normal
	EG	0.106	32	.200	0.972	32	.565	0.292	-0.653	Normal

** It has been accepted that the pre-test scores of the pre-service teachers in the experiment group are normally distributed because the pre-test scores exceeded the specified value of Skewness value and other criteria.*

As seen from Table 2, it can be said that the overall total scores of the ITSPS in the pretest and posttest in the experimental and control groups were normal. In order to provide a normal distribution in a data set, there should be a sample number of at least 40 people. However, in this study, non-parametric analysis may be required since there are less than 40 people in each group (Frankel & Wallen, 2000). For this reason, Mann-Whitney U test was used as a non-parametric statistical analysis technique, while descriptive statistical analysis, T-test and one-way ANCOVA (Analysis of Covariance) were used as parametric statistical analysis technique. The results of the analysis were compared with SPSS statistical program at 0.05 significance level and presented in tables.

Prior to the start of experimental practice, pre-service teachers' self-efficacy levels towards information technology were compared by using the independent sample Mann-Whitney U Test and T-test for the ITSPS according to the experimental and control groups and the results are given in Table 3.

Table 3

Independent Sample Mann-Whitney U Test and T-test Results according to Experiment and Control Groups of Pre-Test Scores of Pre-Service Teachers' ITSPS

Group	*n*	Mean	Mean Rank	Sum of Ranks	Mann-Whitney U Test	T test	*p*
CG	29	94.41	30.62	888.00	453.00	0.208	.874
EG	32	93.47	31.34	1003.00			

As seen in Table 3, the mean rank of the pre-test scores of the pre-service teachers' ITSPS in the control group was found as 30.62, and the mean rank of the pre-test scores of the pre-service teachers' ITSPS in the experiment group as 31.34. There was no statistically significant difference between the mean rank of the pre-test scores of the pre-service teachers' ITSPS according to the experimental and control groups

(U=453.00; p>.05). According to this result, it is seen that both groups were equal in terms of self-efficacy perceptions of information technologies.

After to the start of experimental practice, pre-service teachers' self-efficacy levels towards information technology were compared by using the independent sample Mann-Whitney U Test and T-test for the ITSPS according to the experimental and control groups and the results are given in Table 4.

Table 4

Independent Sample Mann-Whitney U Test and T-test Results according to Experiment and Control Groups of Post-Test Scores of Pre-Service Teachers' ITSPS

Group	*n*	Mean	Mean Rank	Sum of Ranks	Mann-Whitney U Test	T test	*p*
CG	29	93.66	22.19	643.50	208.50	-4.467	.000
EG	32	107.34	38.98	1247.50			

According to Table 4, a statistically significant difference was found when the mean rank of post-test scores of the pre-service teachers' ITSPS were compared according to experimental and control groups (U=-208.50; p<.05). The mean rank of post-test scores of the pre-service teachers' ITSPS in the control group was 22.19; the mean rank of post-test scores of the pre-service teachers' in the experimental group was determined as 38.98. When the mean rank of post-test scores of the pre-service teachers' ITSPS were taken into consideration, it was determined that this a statistically significant difference was favored by the experimental group.

At the end of the experimental applications, the pre-test scores of the pre-service teachers' ITSPS were subtracted from the post-test scores of the pre-service teachers' ITSPS. The difference scores of the pre-service teachers' ITSPS were compared with the independent sample Mann-Whitney U Test and T-test according to the experimental and control groups. The results are given in Table 5.

Table 5

Independent Sample Mann-Whitney U Test and T-test Results according to Experiment and Control Groups of Post-Test/Pre-Test Difference Scores of Pre-Service Teachers' ITSPS

Group	*n*	Mean	Mean Rank	Sum of Ranks	Mann-Whitney U Test	T test	*p*
CG	29	-0.76	23.48	681.00	246.00	-3.475	.002
EG	32	13.88	37.81	1210.00			

According to Table 5, a statistically significant difference was found when the mean rank of post-test/pre-test difference scores of pre-service teachers' ITSPS were compared between experimental and control groups (U=246.00; p<.05). The mean rank of difference scores of pre-service teachers' ITSPS in the control group were 23.48; and

the mean rank of difference scores of pre-service teachers' ITSPS were 37.81. When the mean rank of post-test/pre-test difference scores of pre-service teachers' ITSPS were taken into consideration, it was determined that this a statistically significant difference was favored by the experimental group.

Generally, ANCOVA is used to test whether there is a meaningful difference between the post-test measurement scores of the experiment and control group in experimental designs with pretest-posttest control group (Büyüköztürk, 2008). ANCOVA corrects the mean of post-test scores according to the mean of pre-test scores and then compares adjusted the mean of post-test scores between the groups. For this reason, in this study, the mean of post-test scores of pre-service teachers' ITSPS were compared between the experimental and control groups by covariance with the mean of pre-test scores of pre-service teachers ITSPS in the one-way ANCOVA.

In the one-way ANCOVA, the mean of post-test scores of pre-service teachers' ITSPS were made covariate according to the mean of pre-test scores of pre-service teachers' ITSPS and adjusted the mean of post-test scores of pre-service teachers' ITSPS were tested according to the experimental and control groups. The results are given in Table 6.

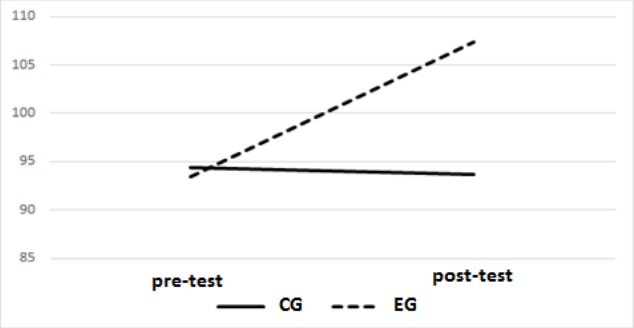
Table 6

One-way ANCOVA Results according to Experiment and Control Groups of Adjusted Post-Test Scores of Pre-Service Teachers' ITSPS

Source of Variance	Sum of Square	*df*	Mean of Square	*F*	*p*	η^2
ITSPS pre-test	1633.412	1	1633.412	13.944	.000	0.194
Group	2966.632	1	2966.632	25.325	.000	0.304
Error	6794.358	58	117.144			
Total	631521.000	61				

According to the one-way ANCOVA results, the mean of the post-test scores of pre-service teachers' ITSPS adjusted by the mean of pre-test scores of pre-service teachers' ITSPS showed a significant difference between the experimental and control groups ($F(1\text{-}58)$=25.325; p<.05). To determine the significance level of this difference, the "effect size" is examined. The effect size (η^2: eta square) ranges from 0.00 to 1.00. This value is small effect if η^2<0.01; it is medium effect if 0.06< η^2<0.14; it is large effect (Büyüköztürk, 2008). At the end of the experimental application, it was determined that the applied method provided a high effect (η^2= 0.304) on the pre-service teachers' ITSPS in the experimental group.

Figure 1. Graphical Representation by the Mean of Pre-Test and Post-Test Scores of Pre-Service Teachers' ITSPS in the Experiment and Control Groups



Discussion

In this study, the effect of using technology on the pre-service science teachers' self-efficacy perceptions towards information technologies (example electronic circuits working microprocessor such as Arduino) was examined in the application of analytical chemistry experiments supported by Arduino. In the study, Arduino was chosen from the microprocessor interfaces. At the beginning of the study, it was determined that the experiment and control groups were equal level according to the mean of pre-test scores of pre-service science teachers' the self-efficacy perceptions. As a result of the study, closed-end chemistry experiments supported by Arduino based on confirmatory approach were found to have a positive effect on pre-service teachers' self-efficacy perceptions according to the mean of the post-scores of their ITSPS.

In this study, the publications examining the effects of different independent variables on attitude, skill, success and self-efficacy development were examined in the literature review.

Within the scope of Robotic and Coding training, positive changes in the cognitive and affective behaviors of the participants were found in experimental studies with open-source microcontrollers such as Arduino (Buluş Kırıkkaya & Başaran, 2019). Similarly to this study, Yenice (2003) investigated the effect of computer-assisted science teaching method applied to 8th grade primary school students on the science and computer attitudes of students. According to the results of the study, it was determined that computer assisted science teaching positively affected students' attitudes towards science and computer. The results obtained thus support the findings of this study. In accordance with this study, the use of computer based technology support in physics laboratory applications has improved the attitudes of the participants towards communication technologies (Arakliotis, Nikolos, & Kalligeros, 2016; Buluş Kırıkkaya & Başaran, 2019; Çömek & Avcı, 2016; Günbatar & Karalar, 2018; Merino, Ruiz, Fernandez, & Gil, 2016; Numanoğlu & Keser, 2017; Oluk & Korkmaz, 2018; Sohn, 2014). It has been seen that activities based on coding in science courses improve students' skills and achievement (Çömek & Avcı, 2016). It can be said that the use of technology support in the direct implementation process in laboratories and science courses has a positive effect on the attitudes, skills and success development in the light of the relevant literature findings and the results obtained in the study. In the same way, it was seen that the programming self-efficacy perception scores and programming performance of the participants were improved in the studies conducted for

programming and coding with different sample groups similar to the self-efficacy results of this study (Altun & Mazman, 2013; Aşkar & Davenport, 2009; Davidson, Larzon, & Ljunggren, 2010; Günbatar & Karalar, 2018; Kasalak, 2017; Mallik & Rajguru, 2018; Ramalingam, LaBelle, & Wiedenbeck, 2004). Indirectly, it can be said that there are positive contributions to attitudes and self-efficacy in technology-supported researches in similar science education with this study. When self-efficacy is evaluated within the context of affective behaviors, it is common for similar findings with other attitudes. Research by Govender and Govender (2009) and Stewart (2012) found a high correlation between technology self-efficacy and attitudes towards technology. Govender and Govender (2009) have identified the link between teachers' self-efficacy perceptions of information and communication technology use and the educational integration of information and communication technologies. A descriptive study was conducted with 1237 teachers. Findings show that teachers have a high perception of self-efficacy in terms of information and communication technologies, they have a positive impact on their attitudes toward technology and their integration into the educational process. Stewart (2012) found that teachers' technology integration was a significant relationship between their self-efficacy and their interest in educational technologies. Likewise, Kayaduman, Sırakaya, and Seferoğlu (2011) investigated the feasibility of the FATIH project and examined the technological infrastructure in education. According to their findings, teachers were found to be inadequate to use technology in education. It has been discovered that this inadequacy is directly related to technology self-efficacy perceptions. As a result of the studies, it seems that teachers need to have a high self-efficacy perception in order to integrate technology into the education process. Therefore, it seems that for effective technology integration in education, there is a need for more effective applications of teachers' self-efficacy perceptions of information technologies. According to the results of the literature and the findings of this study, it can be said that there is a positive correlation between interest in technology and self-efficacy. When the results in the literature are related to the results of this study, it can be said that the analytical chemistry experiments supported by Arduino have developed the self-efficacy of the pre-service teachers and reached the goal of the this study.

At the end of the study, interviews were conducted to support and validate quantitative data. At the end of the study, when the common opinions on the interviews of pre-service teachers are examined; pre-service teachers have reached consensus on common positive views such as “to provide ease of calculation”, “easier to draw”, “more instructive”, “easier to use”, “allow systematic work”, “correct measurement” “Making it easy to use”, “convenience of purchasing”, “possibility to do more than one experiment with one device”, “making the lessons pleasant”, “being a multifunctional and widespread resource”. However, it has been stated that the use of Arduino is difficult, and the connection and use of ports with computers should be learned. Similarly, according to Marangoz (2013), the primary science teachers’ thoughts towards computer-based teaching were examined. According to findings, it was revealed that all the teachers who participated in the research had a positive opinion on the application. At the same time, it has been determined that computer assisted instruction should be used more effectively and teacher education is needed in this direction. In the same study conducted by İnel, Evrekli, and Balım (2011), pre-service

science teachers' opinions towards the use of educational technology in science courses were researched. According to this, it was determined that the pre-science teachers participating in the research had a positive opinion about the integration of educational technology into the course contents. Moreover, it has been determined that pre-service science teachers do not see themselves adequately in terms of technology. Kirkscey (2012) has conducted a study on technology integration in secondary education. In a study with 27 teachers in Texas, teachers indicated that technology made education more permanent and effective. At the same time, they stated that the teacher reduced the burden. When the relevant literature is examined, it is seen that the pre-service teachers have generally expressed favorable views on technology integration. Obtained findings support the result of this study.

Arslan (2018) stated that the use of Arduino as an educational tool may have difficulties. The articles reviewed by Arslan in the literature, showed that the use of Arduino for students who first used Arduino was more difficult than expected and had difficulty in project work (Arslan, 2018). During the interviews conducted in order to support quantitative data, the students stated that they had difficulty in using Arduino in the beginning and that they could use them easily as time passed. They stated that they had difficulties only with port connections and that they had difficulties with library support from time to time. In this study, the students in the experimental group had to use the computer more effectively than the control group. During the activities with Arduino, the students learned the computer setups in the computer environment, they controlled the objects by programming, they learned the coding, they transferred the numerical data obtained from arduino platform to excel format, they graphed, they analyzed and they interpreted the graphics. Besides, students in the experimental group have become accustomed to the arduino computer program. Students in the control group did not receive direct information communication technology support. The students in the control group collected the data in the activities directly by taking notes with paper-pen. Only the students in the control group carried out the warm-up activities they did in the first four weeks. Students in the working groups in the class were asked to write reports in MS Word software in a common template. The students sent their reports to the instructor of the laboratory course via e-mail. For this reason, a development in information technologies self-efficacy was observed in both experimental and control groups. This development can be said to be more in the experimental group. In the interviews conducted with the experimental group for the purpose of verification, the students stated that arduino technology provides easy calculation, easy graphing, data is stored in a concrete and reliable manner; it is used in experiments easily and has a functional and interesting structure. These opinions of the students support the information self-efficacy. For this reason, there may be some more development in the students' self-efficacy in the interactive analytical chemistry laboratory in arduino. For this reason, Altun and Mazman (2013) stated that because of their low self-efficacy perceptions to develop self-efficacy in science teacher sand pre-service science teachers, designing the content from simple to complex, from the outset to the beginning, could have a positive effect on shaping self-efficacy perceptions. According to the opinions of the students, it can be said that the proposal of Altun and Mazman (2013) has been confirmed.

Conclusions

As a result it is concluded that the Arduino microcontroller, which is developed for teaching programming and coding, can be used in analytical chemistry experiments and the participants' self-efficacy regarding information technologies can be improved. As is known, the Arduino microcontroller is commonly used in computer programming, physical laboratory activities and robotic studies, but its' use in chemistry is limited. It is understood that Arduino can be used in chemistry experiments. However, when using this technology, first of all, it should be started from easy activities and the degree of difficulty of activities should be increased as time progresses. Students in the chemistry area who are not accustomed to programming language are forced to use Arduino technology and cannot learn the programming and coding processes. Therefore, students participate to course with low motivation and reluctance. In order to eliminate this negative attitude, students should be encouraged to start the process by designing activities that increase motivation and motivation in the first weeks. At the end of the learning process designed with the principle of easy to hard, it is understood that the students will have high motivation and reach the goals.

Implications

• The development of technology infrastructure should be provided in educational environments according to the opinions of pre-service teachers.

• Pre-service teachers seem to feel inadequate in terms of technology. In this context, teachers should be informed about technology and encouraged to integrate education. At the same time, studies on the use of technological devices in educational environments should be supported.

• As a result of the study, the time savings in the views of pre-service teachers are mentioned. According to this finding, teachers need to incorporate technology into the teaching process in order to use the teaching process efficiently and actively.

• As a result of the implementation, pre-service teachers have indicated that the use of Arduino is more instructive and interesting. Therefore, the teaching process should be enriched with different teaching methods and techniques.

• The integration of technology in the training of pre-service teachers should be emphasized and related trainings should be given.

• Experiments with microprocessors can be varied and used for many different courses.

• The study can be done by choosing different experimental approaches.

References

Akkoyunlu, B. (2002). Educational technology in Turkey: past, present and future. *Educational Media International, 39*(2), 165-174.

Akkoyunlu, B., & Kurbanoğlu, S. (2003). Öğretmen adaylarının bilgi okuryazarlığı ve bilgisayar öz yeterlik algıları üzerine bir çalışma [A study on teacher candidates' perceived information literacy self-efficacy and perceived computer self-efficacy]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi [Hacettepe University Journal of Education],* - (24), 1-10.

Akpınar, E., Aktamış, H., & Ergin, Ö. (2005). Fen bilgisi dersinde eğitim teknolojisi kullanılmasına ilişkin öğrenci görüşleri [Student views on using educational technology in science class]. *The Turkish Online Journal of Educational Technology – TOJET, 4*(1), 93-100.

Aktaş, M. (2013). 5E öğrenme modeli ve işbirlikli öğrenme yönteminin biyoloji dersi başarısına etkisi [Researching the effect of the 5E learning model and cooperative learning metod on academic achivement in biology lesson]. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi [Ahi Evran University Journal of Kirsehir Education Faculty], 14*(3), 37-58.

Altun, A., & Mazman, S.G. (2013). Programlama-1 dersinin BÖTE bölümü öğrencilerinin programlamaya ilişkin öz yeterlilik algıları üzerine etkisi [The effect of introductory to programming course on programming self-efficacy of CEIT students]. *Journal of Instructional Technologies & Teacher Education, 2*(3), 24-29.

Arabacıoğlu, C., Bülbül, H., & Filiz, A. (2007). *Bilgisayar programlama öğretiminde yeni bir yaklaşım [A new approach to computer programming teaching]*. Presented at "Akademik Bilişim Konferansı [Academic Informatics Conference]", January 31-February 2, Kütahya, Turkey.

Arakliotis, S., Nikolos, D. G., & Kalligeros, E. (2016). *Lawris: A rule-based Arduino programming system for young students.* Presented at "5th International Conference on Modern Circuits and Systems Technologies", DOI: 10.1109/MOCAST.2016.7495150.

Arduino (2014). URL: http://arduinoturkiye.com/arduino-mega-2560-nedir/

Arslan, K. (2018). Arduino eğitim için doğru bir araç mı? [Is Arduino the right tool for training?]. In G. Mıhladız (Ed), *Eğitim Bilimlerinde Akademik Araştırmalar [Academic Research in Educational Sciences]*. Ankara: Gece Kitaplığı, Turkey.

Aşkar, P., & Davenport, D. (2009). An investigation of factors related to self-efficacy for java programming. *The Turkish Online Journal of Educational Technology – TOJET January, 8*(1), 26-32.

Bal, F. (2019). Renk terapi'nin depresyon üzerindeki etkisinin incelenmesi [Investigation of the effect of color therapy on depression]. *Uluslararası Sosyal Araştırmalar Dergisi [Journal of International Social Research], 12*(62), 744-752.

Balay, R. (2004). Küreselleşme, bilgi toplumu ve eğitim [Globalization, information society and education]. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi [Ankara University Journal of Faculty of Educational Sciences], 37*(2), 61-82.

Bandura, A. (1997). *Self-efficacy: the exercise of control*. Newyork: Freeman, U.S.A.

Baştürk, R. (2009). Deneme modelleri [Experimental models]. In A. Tanrıöğen (Ed), *Bilimsel araştırma yöntemleri [Scientific research methods] (pp.29-54).* Ankara: Anı Yayıncılık, Turkey.

Buldur, S., & Doğan, A. (2017). Performansa dayalı tekniklerle yürütülen biçimlendirmeye yönelik değerlendirme sürecinin öğrencilerin hedef yönelimlerine etkisi [The Effect of formative assessment process via performance-based techniques on students' goal orientations]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi [H.U. Journal of Education]*, *32*(1), 143-167, doi: 10.16986/HUJE.2016015694

Buluş Kırıkkaya, E., & Başaran, B. (2019). Investigation of the effect of the integration of arduino to electrical experiments on students' attitudes towards technology and ICT by the mixed method. *European Journal of Educational Research*, *8*(1), 31-48. DOI: 10.12973/eu-jer.8.1.31

Büyüköztürk, Ş. (2008). *Sosyal bilimler için veri analizi el kitabı [Hand book of data analysis for social sciences]*. Ankara: PegemA Yayıncılık, Turkey.

Çakmak, O. (1999). Fen eğitiminin yeni boyutu: bilgisayar-multimedya-internet destekli eğitim [New dimension of science education: computer-multimedia-internet-supported education]. *Dokuz Eylül Üniversitesi Buca Eğitim Fakültesi Dergisi [D.E.Ü. Journal of Buca Faculty of Education],* (11), 116-125.

Çengel, M., Alkan, A., & Çayır, E. (2018). In the determination of self-efficacy situations of information technology teachers' coding for middle school students, robotic coding and 3 dimensional design examples of sakarya province. Presented at "INTE - ITICAM - IDEC 2018", Paris-FRANCE. URL:<https://eric.ed.gov/?id=ED590997>

Çepni, S. (2005). Bilim, fen, teknoloji ve eğitim programlarına yansımaları [Reflections on science, technology and education programs]. *In S.Çepni (Ed), Kuramdan uygulamaya fen ve teknoloji öğretimi [Teaching science and technology from theory to practice]*. Ankara: Pegem-A Yayıncılık, Turkey.

Çepni, S. (2007). *Performansların Değerlendirilmesi.* Ankara: PegamA Yayıncılık.

Çiçek, R. (2006). *Eğitim fakültesi 4. sınıf fen bilgisi öğretmen adaylarının teknoloji destekli eğitime ilişkin yeterliklerinin incelenmesi [Researching of the candidate science teachers, who are the education faculty in the fourth class for their sufficiency in the technological assisted education]* (Master's thesis). Celal Bayar Üniversitesi Fen Bilimleri Enstitüsü [C.B.U. Institue of Science]. Manisa, Turkey.

Çömek, A., & Avcı, B. (2016). *Fen eğitiminde robotik uygulamaları hakkında öğretmen görüşleri [Teachers' views on robotics in science education].* Presented at "Uluslararası yükseköğretimde yeni eğilimler kongresi: Değişime ayak uydurmak [International congress on new trends in higher education: keeping up with the change]", 12-13 Nisan [April], Istanbul, Turkey.

Cook, T. D., & Campbell, D. T. (1979). *Quasi-experimentation. Design & analysis issues for field settings.* Chicago: Rand McNally College Publishing Company.

Creswell, J. W. (2003). *Research design: qualitative, quantitative and mixed methods approaches.* California: Sage Publications.

Davidson, K.L., Larzon, L., & Ljunggren, K. (2010). *Self-Efficacy in programming among STS students (Technical Reports)*. Uppsala, Sweden: Upssala University, Department of Information Technology. URL:< https://goo.gl/52RbkD.>

Ekici, E., Ekici, F. T., & Kara, İ. (2012). Öğretmenlere yönelik bilişim teknolojileri öz-yeterlik algısı ölçeğinin geçerlik ve güvenirlik çalışması [Validity and reliability study of ıct self-efficacy perception scale for teachers]. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi [P.U. Journal of Faculty of Education], 31*, 53-65.

El-Abd, M. (2017). A review of embedded systems education in the arduino age: lessons learned and future directions. *International Journal of Engineering Pedagogy, 7*(2), 79-93.

Ercan, İ., & Kan, İ. (2004). Ölçeklerde güvenirlik ve geçerlik [Reliability and validity in the scales]. *Uludağ Üniversitesi Tıp Fakültesi Dergisi [U.U. Journal of Faculty of Medicine], 30*(3), 211-216.

Esteves, M., & Mendes, A. (2004). *A simulation tool to help learning of object oriented programming basics.* Presented at "The 34th ASEE/IEEE Frontiers in Education Conference", October 20-23, Georgia, USA.

Eymen, U.E. (2007). *SPSS 15 veri analiz yöntemleri [Data analysis methods at SPSS 15]*. İstatistik Merkezi [Statistical Center]. URL: http://yunus.hacettepe.edu.tr/~tonta/courses/spring2009/bby606/SPSS_15.0_ile_Veri_Analizi.pdf

Fraenkel, J., & Wallen, N. (2000). *How to design and evaluate research in education (4th ed.).* New York: McGraw Hill, U.S.A.

Gawith, G. (1995). *A serious look at self-efficacy: or waking beeping slooty.* URL: <http://www.theschoolquarterly.com/info_lit_archive/learning_thinking/95_g_g_aslasewbs.htm.>

Geer, R., White, B., & Barr, A. (1998). *The effect of an information literacy subject on teacher education students computing self efficacy.* Presented at "ACEC98", URL: http://www.cegsa.sa.edu.au/conference/acec98/acec98.htm

Gomes, A., & Mendes, A. J. (2007). *Learning to program difficulties and solutions*. Presented at "The International conference on Engineering Education", September 3-7, Coimbra, Portugal.

Görgülü, D., & Küçükali, R. (2013). Öğretmenlerin teknolojik liderlik özyeterliklerinin incelenmesi [Examination of teachers' technological leadership self-efficacy]. *Uluslararası Liderlik Çalışmaları Dergisi: Kuram ve Uygulama [International Journal of Leadership Studies: Theory and Practice], 1*(1), 1-12.

Govender, D., & Govender, I. (2009). The relationship between information and communications technology (ICT) integration and teachers' self-efficacy beliefs about ICT. *Education as Change, 13*(1), 153-165.

Günbatar, M. S., & Karalar, H. (2018). Gender differences in middle school students' attitudes and self-efficacy perceptions towards mBlock programming. European Journal of Educational Research, *7*(4), 925-933.

Halis, İ. (2002). *Öğretim teknolojileri ve materyal geliştirme [Instructional technologies and material development]*. Ankara: Nobel Yayınları, Turkey.

İnel, D., Evrekli, E., & Balım A. G. (2011). Öğretmen adaylarının fen ve teknoloji dersinde eğitim teknolojilerinin kullanılmasına ilişkin görüşleri [Views of science student teachers about the use of educational technologies in science and technology course]. *Kuramsal Eğitimbilim [Journal of Theoretical Educational Sciences]*, *4*(2), 128-150.

ISTE (2016). *Computational thinking teacher resources.* URL: <https://csta.acm.org/Curriculum/sub/CurrFiles/472.11CTTeacherResources_2ed-SPvF.pdf.>

Kaptan, S. (1998). *Bilimsel araştırma ve istatistik teknikleri [Scientific research and statistical techniques]*. Ankara: Tekışık Web Ofset Tesisleri, Turkey.

Karasar, N. (1998). *Bilimsel araştırma yöntemi [Scientific research method]*. Ankara: Nobel Yayın Dağıtım, Turkey.

Karasar, Ş. (2004). New communication technologies in education -internet and virtual higer education. *The Turkish Online Journal of Educational Technology – TOJET*, *3*(4), 117-125.

Kasalak, İ. (2017). *Robotik kodlama etkinliklerinin ortaokul öğrencilerinin kodlamaya ilişkin özyeterlik algılarına etkisi ve etkinliklere ilişkin öğrenci yaşantıları [Effects of robotic coding activities on the effectiveness of secondary school students 'self-efficacy and student experience about activities]* (Master's thesis). Hacettepe Üniversitesi Eğitim Bilimleri Enstitüsü [Hacettepe University, Institue of Educational Science]. Ankara, Turkey.

Kayaduman, H., Sırakaya, M., & Seferoğlu, S.S. (2011). *Eğitimde FATİH projesinin öğretmenlerin yeterlik durumları açısından incelenmesi [Investigation of "increasing opportunities and improvement of technology" project in terms of teacher competencies]*. Presented at "Akademik Bilişim Konferansı [Academic Informatics Conference]", February 2-4, Malatya, Turkey.

Kesercioğlu, T., Balım, A.G., Ceylan, A., & Moralı, S. (2001). *İlköğretim okulları 7. sınıflarda uygulanmakta olan fen dersi konularının öğretiminde görülen okullar arası farklılıklar [Differences between the schools in the teaching of science subjects in the 7th grade]*. Presented at "IV. Fen Bilimleri Kongresi [IV. Congress of Science Education]", September 6-8, Ankara: Mili Eğitim Bakanlığı Yayınevi, Turkey.

Kirkscey, R. (2012). Secondary school instructors' perspectives on the integration of information and communication technologies (ICT) with course content. *American Secondary Education*, *40*(3), 17-33.

Kirschhner, P., & Selinger, M. (2003). The state of affairs of teacher education with respect to information and communications technology. *Pedagogy and Education*, *12*(1), 5–17.

Koballa, T., R., & Crawley, F.E. (1985).The influence of attitude on science teaching and learning. *School Science and Mathematics*, *85*(3), 222-232.

Mains, M. G. (1997). *The effects of learning a programming language on logical thinking skills* (Doctoral Dissertation). University of Nevada, U.S.A.

Mallik, A., & Rajguru, S.B. (2018). *Fundamental: analyzing the effects of a robotics trainingworkshop on the self-efficacy of high school teachers.* Presented at "2018

American Society for Engineering Education Annual Conference & Exposition", June 24-27, Salt Lake City, UT.

Marangoz, M. (2013). *İlköğretim okullarında görev yapan fen ve teknoloji öğretmenlerinin bilgisayar destekli fen ve teknoloji öğretimine ilişkin görüşlerinin incelenmesi-gaziantep ve kilis illeri örneklemi [Analysis of the effect of computer based science and technology instruction in science and technlogy education according to view of science and technology teachers (Sample of Gaziantep and Kilis)]* (Master's thesis). Çukurova Üniversitesi, Sosyal Bilimler Enstitüsü [Çukurova University, Institue of Social Science]. Adana, Turkey.

MEB (2006). *Milli Eğitim Bakanlığı, Öğretmenlik mesleği genel yeterlikleri [Ministry of National Education, General qualifications of teaching profession]*. URL: http://otmg.meb.gov.tr/belgeler/otmg/Yeterlikler.pdf.

Merino, P. P., Ruiz, E. S., Fernandez, G. C., & Gil, M. C. (2016). *Robotic educational tool to engage students on engineering.* Presented at "XII. Technologies Applied to Electronics Teaching Conference", June 20-22, Tenerife, Spain, DOI: 10.1109/FIE.2016.7757417.

Mıhcı-Türker, P., & Pala, F.K. (2018). Ortaokul öğrencilerinin, öğretmenlerin ve öğrenci velilerinin kodlamaya yönelik görüşleri [Opinions of secondary school students, teachers and parents about coding]. *İlköğretim Online [Elementary Education Online], 17*(4), 2013-2029.

Numanoğlu, M., & Keser, H. (2017). Programlama öğretiminde robot kullanımı-mBot örneği [Robot Usage in Programmıng Teachıng - Mbot Example]. *Bartın Üniversitesi Egitim Fakültesi Dergisi [B.U. Journal of Faculty of Education], 6*(2), 497-515.

Oluk, A., & Korkmaz, Ö. (2018). Bilişim teknolojileri öğretmenlerinin eğitsel robotların kullanımına yönelik görüşleri [Information technology teachers' views on the use of educational robots]. S. Dinçer (Ed), *Değişen dünyada eğitim [Education in a changing world]*. Ankara: Pegem Akademi, Turkey.

Ozoran, D., Çağıltay, N. E., & Topallı, D. (2012). *Using scratch in introduction to programming course for engineering students.* Presented at "The 2nd International Engineering Education Conference", Oct.31-Nov.3, Antalya, Turkey.

Pala, F. K., & Mıhcı-Türker, P. (2019). Öğretmen adaylarının programlama eğitimine yönelik görüşleri [Opinions of Teacher Candiates on Programming Education]. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Sciences], 12*(1), 116-134.

Ramalingam, V., LaBelle, D. & Wiedenbeck, S. (2004). *Self-efficacy and mental models in learning to program.* Presented at "Proceedings of the 9th annual SIGCSE conference on Innovation and technology in computer science", June 28-30, Leeds, United Kingdom.

Razali, N. M., & Wah, Y. B. (2011). Power comparisons of shapiro-wilk, kolmogorov-smirnov lilliefors and anderson-darling tests. *Journal of Statistical Modeling and Analytics, 2*(1), 21-33.

Sáez-López, J. M., Román-González, M., & Vázquez-Cano, E. (2016). Visual programming languages integrated across the curriculum in elementary school: A

two year case study using “scratch” in five schools. *Computers & Education*, (97), 129–141, doi:10.1016/j.compedu.2016.03.003.

Saygıner, Ş., & Tüzün, H. (2017a). *Erken yaşta programlama eğitimi: Yurt dışı ve yurt içi perspektiflerinden bir bakış [The education of programming at early age: international and domestic perspectives]*. Presented at “I. Uluslararası Bilgisayar ve Öğretim Teknolojileri Sempozyumu [International Computer and Instructional Technologies Symposium]”, May 24-26, Malatya, Turkey.

Saygıner, Ş., & Tüzün, H. (2017b). *Programlama eğitiminde yaşanan zorluklar ve çözüm önerileri [The difficulties in programming education and suggestions for solutions]*. Presented at “I. Uluslararası Bilgisayar ve Öğretim Teknolojileri Sempozyumu [International Computer and Instructional Technologies Symposium]”, May 24-26, Malatya, Turkey.

Sebetci, Ö., & Aksu, G. (2014). Öğrencilerin mantıksal ve analitik düşünme becerilerinin programlama dilleri başarısına etkisi [The effect of logical and analytical thinking skills on computer programing languages]. *Eğitim Bilimleri ve Uygulama [Educational Sciences and Practice], 13*(25), 65-83.

Sohn, W. (2014). Design and evaluation of computer programming education strategy using arduino. *Advanced Science and Technology Letters, 66,* 73-77. doi:10.14257/astl.2014.66.18

Stewart, J. (2012). *Intrapersonal factors affecting technological pedagogical content knowledge in Oklahoma agricultural education teachers* (Master’s thesis). Oklahoma State University, U.S.A.

Süzen A. A., Ceylan, O., Çetin, A., & Ulusoy, A. (2017). Arduino kontrollü çizim robotu [Drawing robot with ardunio controlled]. *Mehmet Akif Ersoy Üniversitesi Fen Bilimleri Enstitüsü Dergisi [The Journal of Graduate School of Natural and Applied Sciences of Mehmet Akif Ersoy University], Özel Sayı 1*, 79-87.

Swain, P. E. (2013). RAPTOR-A vehicle to enhance logical thinking. *Journal of Environmental Hazards*, *7*(4), 353-359.

Şemseddin, G., & Odabaşı, F. (2004). Bilgi çağında öğretmen adaylarının eğitimde öğretim teknolojileri ve materyal geliştirme dersinin önemi [The importance of instructional technologies and material development course at pre-service teacher education in information age]. *The Turkish Online Journal of Educational Technology*, *3*(1), 43-48.

Uluğ, F. (2000). İlköğretimde teknoloji eğitimi [Technology education in primary education]. *Milli Eğitim Dergisi [Journal of National Education], 146*, 54-68.

Ural, A., & Kılıç, İ. (2006). *Bilimsel araştırma süreci ve SPSS ile veri analizi [Scientific research process and data analysis with SPSS]*. Ankara: Detay Yayıncılık, Turkey.

Usluel, Y., & Seferoğlu, S.S. (2003). *Eğitim fakültelerindeki öğretim elemanlarının bilgisayar kullanımı ve öz-yeterlik algıları [Computer use and self-efficacy perceptions of educators at the faculty of education]*. Presented at “Bilişim Teknolojileri Işığında Eğitim Konferansı ve Sergisi (BTIE) [Education Conference and Exhibition in the Light of Information Technologies]”, May 3-5, ODTÜ Kültür ve Kongre Merkezi-Ankara, Turkey.

Walkowiak, M., & Nehring, A. (2016). Using chemduino, excel, and Powerpoint as tools for real-time measurement representation in class. *Journal of Chemical Education, 93* (4), 778−780.

Yenice, N. (2003). Bilgisayar destekli fen bilgisi öğretiminin öğrencilerin fen ve bilgisayar tutumlarına etkisi [The effect of computer supported science teaching on students' science and computer attitudes]. *The Turkish Online Journal of Educational Technology – The Turkish Online Journal of Educational Technology*, *2*(4), 79-85.

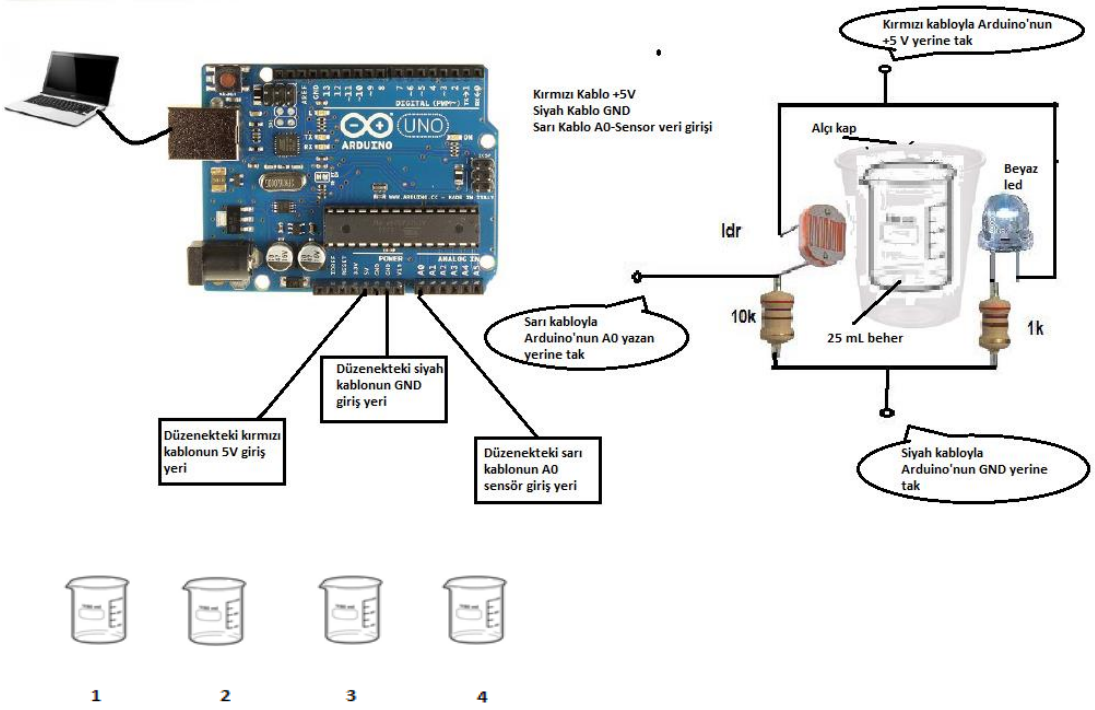
Yükseltürk, E., & Altıok, S. (2016). Investigation of pre-service information technology teachers' game projects prepared with Scratch. *SDU International Journal of Educational Studies, 3*(1), 59-66.

Yükseltürk, E., & Altıok, S. (2017). An investigation of the effects of programming with scratch on the preservice programming. *British Journal of Educational Technology*, *48*(3), 789-801.

Zimmerman, B. J. (1995). Self-efficacy and educational development. In A. Bandura (Ed). *Self-Efficacy in changing socities* (pp. 202 -231). New York: Cambridge University Press, U.S.A.

Appendix-Arduino Chemistry Experiment Test and Program Code Used in Equilibrium Constant Experiment and Colorimetric Analysis Experiment

Schematic Setup of Experiment Plan



Important Information about The Device: This device was prepared in the Colorimetry experiment. This will be used in the experiment. Here is a reminder that the preparation of the apparatus has been explained. A 25 mL plaster mold was prepared by the researcher, taking a 25 mL beaker. The LDR and White led were drilled with a drill from the outside of the plaster mold, as shown in the figure, and the connections were made. The electrical circuit is wrapped with insulated tape so that it is not affected by the solution. As you can see, the red, black and yellow colored cables are laid out on the plaster mold. During the experiment, the pre-service teachers simply placed these cables on the places shown on the Arduino Uno. Pre-service teachers are required to run the program by issuing a pre-prepared command word file. In this way, it is aimed that the process is accelerated with the ready device and that the electronic technical part of the test system is not given to the pre-service teachers and that the analytical chemistry is not taken out.

Arduino Experiment Program Code

```
void setup() {
  Serial.begin(9600);
}
void loop() {
  int sensorValue = analogRead(A0);
  float isik = sensorValue * (5.0 / 1023.0);
  Serial.println(isik);
  delay (500);
}
```

Journal of Theoretical Educational Science, 12(4), 1193-1208, October 2019
Kuramsal Eğitimbilim Dergisi, 12(4), 1193-1208, Ekim 2019
[Online]: https://dergipark.org.tr/akukeg
DOI number: http://dx.doi.org/10.30831/akukeg.455708

The Examination of Prospective Mathematics Teachers' Mathematics Teaching Anxiety Levels

Matematik Öğretmen Adaylarının Matematik Öğretmeye Yönelik Kaygılarının İncelenmesi

Selin ÇENBERCİ*

Received: 29 August 2018 **Research Article** **Accepted:** 19 March 2019

ABSTRACT: The aim of this research is to determine prospective mathematics teachers' mathematics teaching anxiety level who continue Pedagogical Formation Program and who study in Mathematics Education Department at the Faculty of Education. Besides, it is aimed to examine whether the difference is significant in accordance with the program from which teacher education is received and gender variables. The sample of the research consists of 301 prospective math teachers who are in two groups. The study is a descriptive study which is made in accordance with the general survey model and is also a comparative study in which teaching anxiety mean levels of prospective math teachers about mathematics are examined. "The Mathematics Teaching Anxiety Scale" which was developed by Peker (2006) is used to examine the anxiety levels about teaching math of prospective math teachers. As a result of the research, mathematics teaching anxiety mean scores of the prospective math teachers who continue Pedagogical Formation Program and who are studying in Mathematics Education Department at the Faculty of Education are found very close to each other. It is obtained that the prospective math teachers' anxieties for teaching mathematics in two groups have a significant difference in accordance with gender in favor of female ones.

Keywords: mathematics department, teacher candidate, mathematics teaching, anxiety, formation education.

ÖZ: Bu araştırmanın amacı Pedagojik Formasyon Programına devam eden ve Eğitim Fakültesinde öğrenim görmekte olan matematik eğitimi bölümü öğretmen adaylarının matematik öğretmeye yönelik kaygı düzeylerini belirlemektir. Buna ilave olarak bu kaygılarının cinsiyet ve öğretmenlik eğitimi alınan program değişkenine göre anlamlı bir fark gösterip göstermediğini tespit etmektir. Araştırmanın örneklemini bu iki grupta olan toplam 301 matematik öğretmeni adayı oluşturmaktadır. Çalışma genel tarama modelinde yapılmış betimsel aynı zamanda da öğretmen adaylarının matematik öğretmeye yönelik kaygı düzey ortalamalarını inceleyen karşılaştırma çalışmasıdır. Matematik öğretmen adaylarının matematik öğretmeye yönelik kaygı düzeylerini belirlemek için Peker (2006) tarafından geliştirilen "Matematik Öğretmeye Yönelik Kaygı Ölçeği" kullanılmıştır. Araştırmanın sonucunda Eğitim Fakültesinde öğrenim görmekte olan öğretmen adayları ile Pedagojik Formasyon programı matematik öğretmen adaylarının matematik öğretmeye yönelik kaygı puan ortalamaları birbirine çok yakın bulunmuştur. İki gruptaki matematik öğretmen adaylarının matematik öğretmeye yönelik kaygılarının cinsiyete göre kızlar lehine anlamlı bir farklılık gösterdiği tespit edilmiştir.

Anahtar kelimeler: matematik bölümü, öğretmen adayı, matematik öğretimi, kaygı, formasyon eğitimi.

* *Corresponding Author*: Asst. Prof. Dr., Necmettin Erbakan University, Konya, Turkey, scenberci@erbakan.edu.tr, https://orcid.org/0000-0003-4025-7823

Citation Information
Çenberci, S. (2019). The examination of prospective mathematics teachers' mathematics teaching anxiety levels. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science]*, *12*(4), 1193-1208.

ISSN: 1308-1659

Introduction

Mathematics is a tool used in revealing of the talents of individuals and in giving them a logical thinking habit (Bulut, 1994). The mathematics course which is necessary and important for people in every step of their life is one of the lessons that students have difficulty in learning. At every stage of the education process, we encounter to it as a lesson that students develop negative attitudes with different reasons, and consider in a biased way. This negative attitude affects mathematics achievements of students negatively (Kurbanoğlu & Takunyacı, 2012). The Mathematics teaching anxiety has a very important place in the developing of positive attitude towards mathematics course by students (Peker & Mirasyedioglu, 2003). Baloğlu (1999) stated that the anxieties of students regarding mathematics are one of the important problems. Nolting (2010) stated that the reason of this anxiety is subjective Apart from this, one of the reasons of math anxiety is the effect of teachers on students (Alkan, 2011). In other words, this is especially the attitudes and behaviors of the teachers. For this reason, every experience that students have with teachers are important about their attitudes towards mathematics. In addition, Ünlü & Ertekin (2013) stated in their research that the teachers transfer their anxieties regarding mathematics to their students. It is not possible that students who follow in their teachers' footstep do not realize the anxieties of their teachers and are not affected by them. Anxiety towards mathematics is one of the most important obstacles in learning mathematics. In addition to these general reasons, Gresham (2007) said that teaching practices of teachers were one of the reasons causing math anxiety in students. It is emphasized that ability of teachers such as organizing the classroom environment, time management, lesson plan, teaching skills cause emerging of anxiety in teachers (Peker, 2009a). This leads us to math teaching anxiety. Peker (2006) defined mathematics teaching anxiety as "*the feelings of tension and anxiety that are experienced by teachers in teaching mathematical concepts, theorems, formulas* or problem solving." Gardner and Leak (1994) described this anxiety as *"anxiety belonging to the experiences regarding practice of teaching and classroom activities that involve teaching activities."* The teaching anxiety also includes the teacher's own teaching activities (Fish & Fraser, 2001). Peker (2009b) noted that the anxiety regarding mathematics teaching is a fairly common fear among prospective teachers. Also Peker (2006) stated that knowledge of the field, self-confidence and attitude towards mathematics are factors affecting mathematics teaching anxiety and mathematics. Karakaş Türker & Turanlı (2008) stated that attitudes of teachers towards teaching mathematics lecture affected attitudes of students. Ameen, Guffey & Jackson (2002) emphasized in the study that difficulty in responding to questions of students, increases mathematics teaching anxiety. Aslan (2013) noted that there are several studies showing that the teachers have higher math teaching anxiety than the prospective mathematics teachers. It was stressed that reducing the anxieties of prospective teachers before they become teacher is an issue requiring attention in this regard (Liu, 2008). Yenilmez & Duman (2008) stated that perspectives of teachers about the anxiety level of mathematics, the quality of knowledge, affect the quality of mathematics teaching. When considering all of these, it is inevitable that the studies done for determining the anxiety of teachers and prospective math teachers in mathematics teaching has increased in recent years (Peker & Ertekin, 2011). When examining the literature, Akinsola (2008) found in the study that the competence of

problem solving skills in mathematics is inversely related to teaching anxiety. Peker (2009a) found a relationship between math teaching anxiety and learning styles in his study. In addition to this he determined that mathematics teaching anxiety was at the highest level in ones who have divergent learning styles, and this was at the lowest level, on the contrary, in those with convergent learning styles. Umay (2001) obtained in the research that prospective mathematics teachers who study on the primary school mathematics teachers education program at Hacettepe University, have a high belief in their own competences in mathematics. At the same time, by emphasizing the importance of dominating every subject in the field, he stressed that prospective math teachers must have high self-efficacy perceptions regarding mathematics. Tatar, Zengin & Kağızmanlı (2016) conducted a research on 475 mathematics teachers in order to detect their level of anxiety towards mathematics teaching in their study in 2014. As a result of this study, it was obtained that anxiety levels of prospective math teachers regarding mathematics teaching are below the average score value. They also found that the anxiety of prospective math teachers regarding mathematics teaching did not differ in accordance with gender.

Levine (1993) conducted a qualitative research in order to determine the anxiety of primary school prospective math teachers regarding math teaching by examining the weekly and daily plans written by prospective math teachers during the semester. Additionally, studies in which many factors affecting math teaching anxiety of prospective math teachers were identified and examined draw attention. The studies which examine the relationship between prospective mathematics teachers' mathematics teaching anxiety and thinking styles (Altundal, 2013) and their learning styles (Peker, 2008), teaching styles (Sarı & Aksoy, 2016), mathematics self-efficacy perceptions (Ural, 2015), have been done. Peker (2009b) found in his study that the prospective math teachers' mathematics teaching anxiety reduces by micro-teaching practices. Sloan, Daane & Giesen (2002) found that the use of manipulative materials reduces anxiety. Peker (2006) found that use of manipulative materials and creative teaching strategies by prospective teachers, and improving skills by them in designing lesson plans for teaching mathematical concepts, reduce their anxiety levels. He also developed anxiety scale in order to determine anxiety of prospective math teachers regarding mathematics teaching. Başpınar & Peker (2016) studied on the math teaching anxieties of prospective math teachers and their beliefs regarding both education and mathematical. They found that there have been significant negative relations between the primary school prospective mathematics teachers. Demir, Cansız, Deniz, Kansu & İşleyen (2016) investigated in the study whether there was a significant difference in the anxiety scores of the students studying at primary school teacher education department according to the gender, the school graduation and the grade level. Ertekin (2010) found between attitude towards anxiety directed at teaching mathematics and the teaching anxiety meaningful correlations. Ural (2015) found a moderate negative relationship between prospective math teachers' anxiety levels of mathematics teaching and self-efficacy perceptions of them. Peker (2015) declared the relationship between mathematics teaching anxiety of prospective primary school teachers by using path analysis. In addition to this he examined their self-efficacy beliefs toward mathematics teaching. Peker (2016) investigated the relationship between pre-service primary school teachers' mathematics teaching anxiety and their self-efficacy beliefs toward

mathematics teaching through path analysis. Yavuz (2018) aimed in his study to find the prospective classroom and mathematics teachers' level of mathematics teaching anxieties with different variables.

Baki & Gökçek (2007) tried to show how prospective teachers should behave in the class during their lessons. Bekdemir (2007) found that elementary school prospective math teachers have mathematics anxiety in some degree in the study in which the causes of their mathematics anxiety were investigated. Baki (1996, 1997) mentioned that all prospective math teachers have content knowledge, education knowledge and content education knowledge is of importance in order to be able to be good in teaching in the future. The fact that prospective math teachers have enough knowledge about how to teach mathematics, and that feel competent in teaching are the main aims of the Faculty of Education, and the same aims are also considered for Formation Education Program. Today's Education Faculties are known as the institutions that educate teachers, but the mission of teacher training has never been left to the Education Faculties at all. A lot of different steps have been taken in this respect; Pedagogical Formation Education Certificate Programs (PFECP) especially was a very popular program in the years of 2009-2010 (Özkan, 2012). The last amendment regarding teacher education has been made in 2010 at the general assembly of Higher Education Board. Accordingly, graduate programs without thesis were removed and reorganized by replacing with Pedagogical Formation Training. However, these regulations do not give clear information about the attitudes of the students who have taken the Pedagogical Formation Education and graduated from Faculty of Arts and Sciences. And several studies have been made about whether the motivation for loving one's job and sense of service, can be gained with these programs.

As it is known, graduates of Faculty of Education besides graduates of Faculty of Science who had Pedagogical Formation Education started to teach at the primary and secondary schools. The pedagogical formation courses taken by the teacher candidates in both groups are the same and only the teacher candidates in the Faculty of Education receive these courses in their undergraduate education. The main starting point of this study is whether these courses, which are so important for being a teacher, are being internalized or not internalized and contributed to their teaching knowledge and experience. On the other hand, no studies have been found in the country and abroad which examine the relationship between the levels of anxiety levels of mathematics education teacher candidates who are studying in the Faculty of Education and studying in Faculty of Science and continuing Pedagogical Formation education. The aim of this research is to find prospective math teachers' level of mathematics teaching anxieties in department of mathematics who continue Pedagogical Formation Education in order to acquire teaching knowledge and skills for graduates of Science and Arts Department and prospective math teachers' anxiety levels for teaching mathematics who study in Mathematics Education Department at the Faculty of Education and to explore whether there is a relationship between these two. For this purpose, answers to the following questions are sought.

1. What are the mathematics teaching anxiety levels of the prospective math teachers who study in Mathematics Education Department at the Faculty of Education and who continue Pedagogical Formation Program?

2. Do the mathematics teaching anxiety levels of the prospective math teachers who study at the Faculty of Education and who continue Pedagogical Formation Program show a significant difference in accordance with the program from which teacher education is received?
3. Do the mathematics teaching anxiety levels of the prospective math teachers who study in Mathematics Education Department and who continue Pedagogical Formation Program show a significant difference in accordance with their genders?

Aim and Importance

School teaching is a profession that needs to be combined with theoretical knowledge as well as practice and everyday life. When examining in terms of candidates with such a valuable profession, these issues above have great importance for especially mathematics course that is hardly learned and taught. Teaching mathematics in our country causes emergence of mathematics fear and anxiety in the students due to different factors and negatively affects the reactions of students against mathematics course (Şahan, 2006). In addition to this, determining the reasons which increase the anxiety about mathematics teaching, and eliminating them will contribute to the graduation of prospective mathematics teachers who can teach mathematics properly and educate successful students having high self-confidence. It has not been encountered to any studies in Turkey and abroad literature investigating prospective math teachers' anxiety towards teaching mathematics related to the comparison of the Pedagogical Formation Program' and the Faculty of Education'. The aim of this study is to determine prospective mathematics teachers' levels of mathematics teaching anxiety and to examine whether the mathematics teaching anxiety level of them differ in accordance with some variables.

Methodology

This study which is investigated the mathematics teaching anxiety levels of prospective math teachers who study in Mathematics Education Department at the Faculty of Education and the Pedagogical Formation Program is a descriptive study done in accordance with the general survey model. At the same time, it is a comparative study which examines prospective mathematics teachers' average teaching anxiety level for mathematics.

Participants

The sample of this study consists of the 301 prospective math teachers who studied in Math Education Department at Faculty of Education and who continued the Pedagogical Formation Program. Since reaching the whole of the universe was not possible under the present conditions and samples were selected among pre-service teachers with sampling method.

Data Collection Tool

In order to find the mathematics teaching anxiety level of prospective math teachers, a 5-digit Likert-type Anxiety Scale which consists of 23 items and developed by Peker (2006), was used. Anxiety Scale regarding Teaching Mathematics is a scale with 4 factors are given anxiety due to self-confidence (6 items), anxiety due to attitude

towards teaching mathematics (4 items), anxiety due to knowledge about content education (3 items) and anxiety due to content knowledge (10 items). Factor loadings in sub-factors of Mathematics Teaching Anxiety Scale are between 0.53 and 0.86 for anxiety due to content knowledge, between 0.57 and 0.76 for anxiety due to self-confidence, between 0.61 and 0.70 for anxiety due to attitude toward teaching mathematics, and between 0.68 and 0.78 for anxiety due to knowledge about content education. The reliability coefficient of the scale is 0.91. The reliability coefficient calculated for each sub-factor are 0.90 for anxiety sub factor due to content knowledge, 0.83 for anxiety sub factor due to self-confidence, 0.71 for anxiety sub factor due to attitude towards mathematics teaching, and 0.61 for anxiety sub factor due to knowledge about content education, total scale: 0.91.

Data Analysis

In this research descriptive statistics were used such as arithmetic mean and standard deviation for the anxieties towards mathematics teaching of prospective math teachers who continued Pedagogical Formation Program and who were studying in Mathematics Education Department and Mann Whitney-U statistics were used for data which did not show normal distribution. The prerequisite for the significance tests of independent group averages is that the scale data are intermittent or proportional and have normal distribution (Büyüköztürk, 2010). When these preconditions are examined, it is seen that the data are intermittent. The skewness and kurtosis coefficients and Kolmogorov-Smirnov values of Mathematics Teaching Anxiety Scores (MATAS) were calculated to examine the normal distribution of data. Data values not having normal distribution are given in Table 1.

Table 1

The Results of Kolmogorov-Smirnov Test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	*df*	Sig.	Statistic	*df*	Sig.
anxietyf1	.139	301	.000	.895	301	.000
anxietyf2	.105	301	.000	.977	301	.000
anxietyf3	.204	301	.000	.850	301	.000
anxietyf4	.176	301	.000	.918	301	.000

[a] *Lilliefors Significance Correction*

Results

In this section, the findings obtained about the mathematics teaching anxiety level of prospective math teachers were given in the direction of the sub-problems.

Mathematics Teaching Anxiety Levels of the Prospective Mathematics Teachers

The first sub-problem of the study is addressed with the following question: "What are the mathematics teaching anxiety levels of the prospective math teachers who

study in Mathematics Education Department and who continue Pedagogical Formation Program?"

In order to answer this sub-problem, the descriptive statistical data were examined, and the arithmetic mean and the standard deviation values belonging to the scores of anxiety of the pre-service teachers towards the math teaching were given according to the following scale sub-dimensions: "anxiety due to content knowledge", "anxiety due to self-confidence", "anxiety due to attitude towards mathematics teaching" and "anxiety due to teaching knowledge".

Table 2

Descriptive Statistics Belonging to Scores of Anxiety of Prospective Math. Teachers towards Math Teaching

	Faculty of Education			Pedagogical Formation Program		
Sub-Dimensions	*n*	$\bar{X}$	*SS*	*n*	$\bar{X}$	*SS*
Anxiety due to content knowledge	211	4.05	.686	90	4.07	.730
Anxiety due to self-confidence	211	2.29	.591	90	2.36	.537
Anxiety due to attitude towards mathematics teaching	211	1.79	.683	90	1.78	.599
Anxiety due to teaching knowledge	211	2.05	.550	90	1.96	.618
Anxiety towards math teaching	211	2.94	.318	90	2.95	.279

The mean score belonging to prospective mathematics teachers' mathematics teaching anxiety for Mathematics Education Department was found as 2.94, the mean score belonging to "anxiety due to content knowledge" was found the highest (4.05), and the mean score belonging to sub-dimension of "anxiety due to attitude towards mathematics teaching" was found the lowest (1.27). Since the mean score belonging to anxiety for teaching mathematics corresponds to the value between 2.60 and 3.39 in the evaluation scale, we can say that the prospective math teachers' anxiety level for teaching mathematics is moderate. Since the mean score belonging to "anxiety due to content knowledge" corresponds to the value between 3.40 and 4.19 in the evaluation it can be said that prospective math teachers have fairly anxiety for this issue. Since the mean score belonging to "anxiety due to attitude towards mathematics teaching" corresponds to the value between 1.00-1.80 in the evaluation scale, we can say that the prospective math teachers have low level of math teaching anxiety for this issue.

The mean score of teaching anxiety which belongs to prospective math teachers who continued Pedagogical Formation Program found 2.95, the mean score belonging to "anxiety due to content knowledge" was found the highest (4.07), and the mean score belonging to sub-dimension of "anxiety due to attitude towards mathematics teaching" was found the lowest (1.79). Since the mean score belonging to mathematics teaching anxiety corresponds to the value between 2.60 and 3.39 in the evaluation scale, this says that the prospective math teachers' anxiety level for mathematics teaching is moderate. Since the mean score belonging to "anxiety due to content knowledge" corresponds to the value between 3.40 and 4.19 in the evaluation scale, it can be said that prospective math

teachers have rather than math teaching anxiety for this issue. Since the mean score belonging to "anxiety due to attitude towards teaching mathematics" corresponds to the value between 1.00 and 1.80 in the evaluation scale we can say that the prospective math teachers have low level of mathematics teaching anxiety for this issue.

The fact that the mean mathematics teaching anxiety score of prospective math teachers who studied in Mathematics Education Department and the mean mathematics teaching anxiety score of prospective mathematics teachers who continued Pedagogical Formation Program are close to each other show that prospective math teachers in two groups have the same anxiety.

Comparison Prospective Mathematics Teachers' Mathematics Teaching Anxiety Levels According to the Teacher Education Program

The second sub-problem of the study is addressed with the following question: "Do the mathematics teaching anxiety levels of the prospective math teachers who study at Faculty of Education and who continue Pedagogical Formation Program show a significant difference in accordance with the program from which teacher education is received?"

In order to test our hypothesis, the data, which show non-normal distribution and were obtained Mann-Whitney U test, and which belong to mathematics teaching anxiety scores of the prospective math teachers in accordance with the program from which teacher education is received variable, are given in Table 3.

These differences which were revealed in accordance with the variable of the program from which teacher education is received are not significant ($p>.05$). According to the variable of the program from which teacher education is received, the prospective math teachers' mathematics teaching anxiety scores of the who studied at the Faculty of Education were found lower than the mean scores of prospective math teachers who continued Pedagogical Formation Program in the sub-dimensions of "anxiety due to content knowledge", "anxiety due to self-confidence" and "anxiety due to attitude towards mathematics teaching". For these sub-dimensions, it can be said that the prospective math teachers who studied at the Faculty of Education have less anxiety regarding mathematics teaching. The anxiety scores of the prospective math teachers who continued Pedagogical Formation program were found lower than the mean scores of prospective mathematics teachers who studied at the Faculty of Education in the sub-dimensions of "anxiety due to teaching knowledge" and "anxiety towards math teaching". For these, it can be stated that the prospective math teachers who studied at the Faculty of Education have much more anxiety regarding mathematics teaching.

Table 3

Mathematics Teaching Anxiety Scores According to the Teacher Education Program Variable, Mann-Whitney U Test Results

Factor	Program	*N*	Mean Rank	Rank Sum	Mann-Whitney U	*p*
Anxiety due to content knowledge	Faculty of Education	211	150.52	31759.00	9393.000	.882
	Pedagogical For. Program	90	152.13	13692.00		
Anxiety due to self-confidence	Faculty of Education	211	147.57	31138.00	8772.000	.293
	Pedagogical For. Program	90	159.03	14313.00		
Anxiety due to attitude towards mathematics teaching	Faculty of Education	211	149.53	31550.00	9184.000	.648
	Pedagogical For. Program	90	154.46	13901.00		
Anxiety due to teaching knowledge	Faculty of Education	211	156.28	32975.00	8381.000	.097
	Pedagogical For. Program	90	138.62	12476.00		
Anxiety towards math teaching	Faculty of Education	211	152.81	32242.00	9114.000	.581
	Pedagogical For. Program	90	146.77	13209.00		

Comparison Prospective Mathematics Teachers' Mathematics Teaching Anxiety Levels According to the Gender

The third sub-problem of the study is addressed with the following question: "Do the mathematics teaching anxiety levels of the prospective math teachers who study in Math Education Department and who continue Pedagogical Formation Program show a significant difference in accordance with their genders?"

In order to test our hypothesis, the data, which show non-normal distribution and were obtained Mann-Whitney U test, and which belong to mathematics teaching anxiety scores of the prospective math teachers in accordance with gender variable, are given in Tables 4 and 5.

Table 4

Math. Teaching Anxiety Scores of Mathematics Education Department According to the Gender Variable, Mann-Whitney U Test Results

Factor	Gender	*N*	Mean Rank	Rank Sum	Mann-Whitney U	*p*
Anxiety due to motivational content knowledge	Female	176	108.72	19135.00	2601.000	.146
	Male	35	92.31	3231.00		
Anxiety due to self-confidence	Female	176	109.32	19241.00	2495.000	.075
	Male	35	89.29	3125.00		
Anxiety due to attitude towards mathematics teaching	Female	176	105.30	18532.00	2956.000	.702
	Male	35	109.54	3834.00		
Anxiety due to teaching knowledge	Female	176	106.87	18809.00	2927.000	.632
	Male	35	101.63	3557.00		
Total anxiety towards math teaching	Female	176	109.86	19336.00	2400.000	.039
	Male	35	86.57	3030.00		

According to the gender variable, there is a significant difference only in sub-dimension of "total anxiety towards math teaching" between mean mathematics teaching anxiety scores of prospective math teachers who studied in the Mathematics Education Department. This difference is in favor of female prospective mathematics teachers.

Table 5

Math. Teaching Anxiety Scores of Pedagogical Formation Program According to the Gender Variable, Mann-Whitney U Test Results

Factor	Gender	*N*	Mean Rank	Rank Sum	Mann-Whitney U	*p*
Anxiety due to motivational content knowledge	Female	62	45.25	2805.50	852.500	.892
	Male	28	46.05	1289.50		
Anxiety due to self-confidence	Female	62	48.74	3022.00	667.000	.078
	Male	28	38.32	1073.00		
Anxiety due to attitude towards teaching mathematics	Female	62	49.95	3097.00	592.000	.015
	Male	28	35.64	998.00		
Anxiety due to teaching knowledge	Female	62	50.21	3113.00	576.000	.009
	Male	28	35.07	982.00		
Total anxiety towards math teaching	Female	62	49.31	3057.50	631.500	.039
	Male	28	37.05	1037.50		

According to the gender variable, there is a significant difference in sub-dimensions of "anxiety due to attitude towards teaching mathematics" and "anxiety due to teaching knowledge" and "total anxiety towards math teaching" between mean anxiety scores towards mathematics teaching of prospective math teachers who continued the Pedagogical Formation Program. These differences are in favor of female prospective math teacher can in all three groups. It can be said that female prospective math teachers have much more anxiety regarding teaching mathematics in three groups.

Conclusion and Discussion

In this research, the mathematics teaching anxiety levels of the prospective math teachers who studied in Mathematics Education Department at the Faculty of Education and the mathematics teaching anxiety levels of prospective math teachers who continued Pedagogical Formation Program were examined, and the sub-dimensions of the teaching anxiety arising from the teaching knowledge, self-confidence, content knowledge and attitude towards mathematics teaching were also described in detail.

The mean score belonging to mathematics teaching anxiety level of prospective math teachers who studied in Mathematics Education Department was found as 2.94 and we can say that their mathematics teaching anxiety level is moderate. The mean score belonging to mathematics teaching anxiety level of prospective mathematics teachers who continued the Pedagogical Formation program was found as 2.95 and we can say that their mathematics teaching anxiety level is moderate too. In this context, since the mean mathematics teaching anxiety score of prospective mathematics teachers both of them are close to each other, this say that prospective mathematics teachers in two groups have the same mathematics teaching anxiety level. As a reason for this, it can be said that mathematics prospective math teachers found themselves sufficient at moderate level in teaching mathematics. According to the findings of Tatar et al. (2016), since the general mathematics teaching anxiety levels of prospective math teachers were below the mean score value, it was determined that their general mathematics teaching anxiety were at low level. It was determined that anxiety of prospective math teachers towards mathematics teaching were at a low level in the study of Hacıömeroğlu (2014) in which the relationship between mathematics anxiety and mathematics teaching anxiety of elementary prospective math teachers were investigated. It is seen that the results of our study do not coincide with these mentioned studies.

From the perspective of sub-dimensions, at the levels of mathematics teaching anxiety, the mean scores belonging to the sub-dimension of "anxiety due to content knowledge" of prospective mathematics teachers who studied in Mathematics Education Department and continued the Pedagogical Formation Program, are the highest with (4.05) and (4.07), respectively. This shows that prospective math teachers have high level of anxiety. The mean scores belonging to sub-dimension of "anxiety due to attitude towards teaching mathematics" were found to be lowest with (1.27) and (1.79), respectively. This says that the prospective math teachers' math teaching anxiety levels are low. In general, it is obtained that the score levels of "anxiety towards teaching mathematics, anxiety due to teaching knowledge and self-confidence" were below the mean score. When the study of Tatar et al. (2016) is examined in terms of the sub-dimension of "anxiety towards teaching mathematics"; it was observed that the

score levels of the prospective mathematics teachers were lower than the mean score in sub-dimension of “anxiety due to teaching knowledge, attitude towards teaching mathematics, content knowledge and self-confidence.” The results of our research coincide with the research of Tatar et al. (2016) except for the sub-dimension of “teaching knowledge.” It is possible to say that the high anxiety level of the prospective math teachers in the sub-dimension of “motivational teaching knowledge” is due to lack of practice and experience and not having motivation in this direction.

According to the program from which teacher education is received variable, when considering the sub-dimensions of “anxiety due to attitude towards teaching mathematics, anxiety due to self-confidence, anxiety due to teaching knowledge”; the mathematics teaching anxiety mean scores of the prospective math teachers who studied at the Faculty of Education were found to be lower than the mean scores of the prospective math teachers who continued Pedagogical Formation Program. According to these sub-dimensions, it can be stated that the prospective math teachers who studied at the Faculty of Education have less mathematics teaching anxiety. In the sub-dimension of “anxiety due to teaching knowledge”; the mean scores of anxiety towards teaching mathematics of the prospective math teachers who continued Pedagogical Formation Program were found to be lower than prospective math teachers who studied at the Faculty of Education. According to this sub-dimension, it can be stated that the prospective math teachers who studied at the Faculty of Education have much more mathematics teaching anxiety. In general, these differences which were revealed in accordance to the program from which teacher education is received variable are not significant ($p > .05$).

According to the gender variable, it can be stated that female prospective math teachers in both groups have much more teaching anxiety for mathematics. There is a significant difference is in favor of female students only in sub-dimension of “total anxiety towards math teaching” between the mean scores of prospective math teachers who studied in the Department of Mathematics Education. In the study conducted by Akgün, Gönen, and Aydın (2007), it was also determined that female prospective mathematics teachers in both branches (science and mathematics) have high anxiety levels than male prospective math teachers. In the study conducted by Elmas (2010), it was found significant difference at the anxiety towards teaching mathematics of the classroom prospective math teachers, according to the gender generally. In this study, it was concluded that female prospective math teachers had higher levels of anxiety regarding teaching mathematics than male prospective math teachers. However, our study does not coincide with studies of Peker and Halat (2008), Peker, Halat, and Mirasyedioğlu (2010).

There is a significant difference between the mean scores of Pedagogical Formation program prospective math teachers belonging to the sub-dimension of the “anxiety due to the knowledge about content education” and “anxiety due to attitude towards teaching mathematics” in accordance with gender. These differences are in favor of female students in all three groups. In the study of Tatar et al. (2016), there was no significant difference between prospective math teachers’ the mathematics teaching anxiety levels belonging to the sub-dimensions of "total anxiety towards teaching mathematics”, “anxiety due to attitude toward teaching mathematics”, "anxiety due to content knowledge”, “anxiety due to the teaching knowledge" and “anxiety due to self-

confidence" in accordance with gender. Our study overlaps with the study of Tatar et al. (2016) in terms of the sub-dimensions of "anxiety due to content knowledge" and "anxiety due to self-confidence."

Implications

According to the results obtained in this research, the followings can be suggested: The duration of teaching practice courses can be increased in the teacher education at undergraduate level and the pedagogical formation programs. Research aiming to reveal sources of anxiety and in particular anxiety towards math teaching can be done. New research on the anxiety towards mathematics teaching can be done by using samples selected from different levels of education and universities.

References

Akgün, A., Gönen, S., & Aydın, M. (2007). The investigation of anxiety levels of primary school science and mathematics teacher students' according to some variables. *Electronic Journal of Social Sciences, 6(*20), 283-299.

Akinsola, M. K. (2008). Relationship of some psychological variables in predicting problem solving ability of in-service mathematics teachers. *The Montana Mathematics Enthusiast, 5*(1), 79-100.

Alkan, V. (2011). One of the barriers to providing effective mathematics teaching: anxiety and its causes. *Pamukkale University Journal of Education. 29*(1), 89-107.

Altundal, H. (2013). *Öğretmen adaylarının düşünme stilleri ile matematik ögretim kaygısı arasındakı ilişkinin incelenmesi.* M.Sc.Thesis. Necmettin Erbakan University Educational Sciences Institute, Konya.

Ameen, E. C., Guffey, D. M., & Jackson, C. (2002). Evidence of teaching anxiety among accounting educator. *Journal of Education for Business, 78*(1), 16-22.

Aslan, D. (2013). A comparison of pre and in-service preschool teachers' mathematical anxiety and beliefs about mathematics for young children. Part-II*: Social Sciences and Humanities, 4*(2), 225-230.

Baki, A. (1996). *Nitelikli matematik öğretmeninin alan eğitimi bilgisi*. Modern Öğretmen Yetiştirmede Gelişme ve İlerlemeler Sempozyumu, Ankara.

Baki, A. (1997). Çağdas gelişmeler ışığında matematik öğretmenliği eğitimi programları. *Education and Science, 21*(103), 46-54.

Baki, A., & Gökçek, T. (2007). Some clues regarding to teacher model adopted by pre-service mathematics teachers. *Hacettepe University Journal of Education*, 32, 22-31.

Baloğlu, M. (1999). A comparison of mathematics anxiety and statistics anxiety in relation to general anxiety. Eric Document Reproduction Service No, E.D. 436 703.

Başpınar, K., & Peker, M. (2016). The relationship between pre-service primary school teachers' mathematics teaching anxiety and their beliefs about teaching and learning mathematics. *Journal of Theoretical Educational Science, 9*(1), 1-14.

Bekdemir, M. (2007). The causes of mathematics anxiety in elementary pre-service teachers and proposals for decreasing mathematics anxiety (The example of faculty of Erzincan education). *Erzincan University Journal of Education, 9*(2), 131-144.

Bulut, S. (1994). *Matematik öğretiminde kullanılan yöntem ve teknikler*. TED XII. Öğretim Toplantısı Bildirileri.

Büyüköztürk, Ş. (2010). *Sosyal bilimler için veri analizi el kitabı*. Ankara: Pegem Akademi Publications.

Demir, B. K., Cansız, S., Deniz, D., Kansu, C. C., & İşleyen, T. (2016). The investigation of primary school teacher candidates' anxiety levels for teaching mathematics in terms of different variables (The example of Bayburt). *Bayburt University Journal of Education, 11*(2), 379-390.

Elmas, S. H. (2010). *Sınıf öğretmeni adaylarının matematik öğretmeye yönelik kaygı düzeyleri ve bu kaygıya neden olan faktörler* (Unpublished M.Sc. Thesis), Afyon Kocatepe Üniversitesi, Sosyal Bilimler Enstitüsü, Afyon.

Ertekin, E. (2010). Correlations between the mathematics teaching anxieties of pre-service primary education mathematics teachers and their beliefs about mathematics. *Educational Research and Reviews*, *5*(8), 446-454.

Fish, T. A., & Fraser, I. H. (2001). Exposing the iceberg of teaching anxiety: A survey of faculty at three New Brunswick universities. *Electronic Journal of the American Association of Behavioral and Social Sciences*, 4. Available at http://www.aabss.org/journal2001/Fish2001.jmm.html. [Accessed May. 10, 2010].

Gardner, L., & Leak, G. (1994). Characteristics and correlates of teaching anxiety among college psychology teachers. *Teaching of Psychology*, *21*(1), 28-32.

Gresham, G. (2007). A Study of mathematics anxiety in pre-service teachers. *Early Childhood Education Journal*, *35*(2), 181-188.

Haciömeroğlu, G. (2014). Elementary pre-service teachers' mathematics anxiety and mathematics teaching anxiety. *International Journal for Mathematics Teaching and Learning*. Downloaded from http://www.cimt.plymouth.ac.uk/journal/haciomeroglu.pdf.

Karakaş-Türker, N., & Turanlı, N. (2008). Developing an attitude scale for mathematics education courses. *Gazi Journal of Educational Sciences, 28*(3), 17-29.

Kurbanoğlu, N.İ., & Takunyacı, M. (2012). An investigation of the attitudes, anxieties and self-efficacy beliefs towards mathematics lessons high school students' in terms of gender, types of school and students' grades. *Journal of Human Sciences*, *9*(1), 110-130.

Levine, G. (1993). *Prior mathematics history, anticipated mathematics teaching style, and anxiety for teaching mathematics among pre-service elementary school teachers*. Paper presented at the Annual Meeting of the International Group for Psychology of Mathematics Education, North American Chapter.

Liu, F. (2008). Impact of online discussion on elementary teacher candidates' anxiety towards teaching mathematics. *Education*, *128*(4), 614-629.

Nolting, P. D. (2010). *Math study skills workbook* (Fourth Edition). USA: Brooks/Cole.

Özkan, H. H. (2012). Öğretmenlik Formasyon Programındaki Öğretmen Adaylarının Öğretmenlik Mesleğine İlişkin Tutumlarının İncelenmesi, *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, 13(2), 29-48.

Peker, M. (2006). The Development of mathematics teaching anxiety scale. *Journal of Educational Sciences & Practices*, *5*(9), 73-92.

Peker, M. (2008). Pre-service teachers' teaching anxiety about mathematics and their learning styles. *Eurasia Journal of Mathematics, Science & Technology Education*, *5*(4), 335-345. doi: https://doi.org/10.12973/ejmste/75284.

Peker, M. (2009a). Pre-service mathematics teacher perspectives about the expanded microteaching experiences. *J. Turk. Educ. Sci*., *7*(2), 353-376.

Peker, M. (2009b). Pre-service teachers' teaching anxiety about mathematics and their learning Styles. *Eurasia J. Math., Science & Technology Education*, *5*(4), 335-345.

Peker, M. (2015). *The relationship between mathematics teaching anxiety and self-efficacy beliefs toward mathematics teaching*. International Conference on Social Sciences and Education Research, Antalya, Turkey.

Peker, M. (2016), Mathematics teaching anxiety and self-efficacy beliefs toward mathematics teaching: A path analysis. *Educational Research and Reviews*, *11*(3), 97-104.

Peker, M., & Ertekin, E. (2011). The relationship between mathematics teaching anxiety and mathematics anxiety. *The New Educational Review, 23*(1), 213-226.

Peker, M., & Halat, E. (2008). *The pre-service elementary school teachers' mathematics teaching anxiety and gender*. The European Conference On Educational Research, Goteborg, Sweden.

Peker, M., & Mirasyedioğlu, S. (2003). Lise 2. sınıf öğrencilerinin matematik dersine yönelik tutumları ve başarıları arasındaki ilişki, *Pamukkale University Journal of Education Faculty, 2*(14), 157-166.

Peker, M., Halat, E., & Mirasyedioglu, Ş. (2010). Gender related differences in mathematics teaching anxiety. *The Mathematics Educator, 12*(2), 125-140.

Sarı, M. H., & Aksoy, N. C. (2016). The relationship between mathematics teaching anxiety and teaching style of primary school teachers. *Turkish Studies-International Periodical for the Language*s. *11*(3), 1953-1968.

Sloan, T., Daane, C. J., & Giesen, J. (2002). Mathematics anxiety and learning styles: What is the relationship in elementary pre-service teachers? *School Science and Mathematics, 102*(2), 84-87.

Şahan, G. (2006). *Matematik korkusunda öğretmenin rolü düzeltildi*. Eğitim Bilimleri Kongresi. Muğla, Türkiye.

Tatar, E., Zengin Y., & Kağızmanlı, T.B. (2016). Öğretmen adaylarının matematik öğretmeye yönelik kaygı düzeylerinin incelenmesi. *Journal of Theoretical Educational Sciences, 9*(1), 38-56.

Umay, A. (2001). İlköğretim matematik öğretmenliği programının öğrencilerin matematiğe karşı özyeterlik algısına etkisi. *Journal of Qafqaz University, 8*(1), 1-8.

Ural, A. (2015). The effect of mathematics self-efficacy on anxiety of teaching mathematics. *Journal of Theoretical Educational Sciences, 8*(2), 173-184.

Ünlü M., & Ertekin E. (2013). The Relationship between mathematics teaching self-efficacy and mathematics self-efficacy. *Proc. Soc. Behav. Sci*., 106, 3041-3045.

Yavuz, G. (2018). Do prospective teachers have anxieties about teaching mathematics? *International Journal of Higher Education, 7*(2), 69-75.

Yenilmez, K., & Duman, A. (2008). İlköğretimde matematik başarısını etkileyen faktörlere ilişkin öğrenci görüşleri. *Kırgızistan Manas Üniversitesi Sosyal Bilimler Dergisi*, 19, 251-268.

Journal of Theoretical Educational Science, 12(4), 1209-1222, October 2019
Kuramsal Eğitimbilim Dergisi, 12(4), 1209-1222, Ekim 2019
[Online]: https://dergipark.org.tr/akukeg
DOI number: http://dx.doi.org/10.30831/akukeg.451395

Statistical Self-Efficacy Beliefs among Pre-Service Mathematics Teachers: The Case of Palestine

Matematik Öğretmen Adaylarının İstatistik Öz-Yeterlik İnançlarının İncelenmesi: Filistin Örneği

Emin AYDIN[*] **Eyüp SEVİMLİ**[**] **Saja ABED**[***]

Received: 06 August 2018 **Research Article** **Accepted:** 17 July 2019

ABSTRACT: One of the most concrete reflections of mathematics in real life is statistic domain and it is frequently mentioned in the related literature that students have difficulty in statistics concepts. The development of statistical concept knowledge is important for both statistical and scientific literacy. This study aimed to determine pre-service mathematics teachers' self-efficacy beliefs in statistics. The study is about the Palestinian context. Any data about the Palestinian education is valuable as there is so little research in the literature about the educational research done about Palestinian educational system. The present study was conducted with a total number of 100 pre-service mathematics teachers who were in their last academic year in the mathematics department of two Palestinian universities. Data was collected by the Statistics Self- Efficacy Belief Instrument. Descriptive statistics was used in data analysis. Data analysis showed that the participants had low to moderate level of self-efficacy beliefs in statistics. The difficulties faced by the pre-services mathematics teachers with low self-efficacy beliefs in the teaching of statistics concepts are discussed and the suggestion of remedial solutions for teaching content and teaching environment is shared.

Keywords: statistics education, teacher training, self-efficacy.

ÖZ: Matematiğin gerçek yaşamdaki en somut yansımalarından biri de istatistik alanıdır ve ilgili literatürde öğrencilerin ve matematik öğretmen adaylarının istatistik kavramlarını anlamada zorlandıkları sıkça dile getirilmektedir. İstatistik kavram bilgisinin geliştirilmesi hem istatistik hem de bilim okuryazarlığının geliştirilmesi açısından önem arz etmektedir. Bu çalışma, matematik öğretmen adaylarının istatistik öz-yeterlik inançlarını belirlemeyi amaçlamıştır. Çalışma Filistin bağlamı ile ilgilidir. Filistin eğitimine ilişkin herhangi bir veri, literatürde Filistin eğitim sistemi hakkında yapılan eğitim araştırması hakkında çok az araştırma olduğu için özel bir önem taşımaktadır. Bu çalışma, son akademik yılında Filistin devlet sınırları içerisinde bulunan iki ayrı üniversitesinin matematik bölümünde kayıtlı olan toplam 100 matematik öğretmen adayı ile gerçekleştirilmiştir. Veriler İstatistik Öz-Yeterlik İnanç Envanteri tarafından toplanmıştır. Veri analizinde tanımlayıcı istatistikler kullanılmıştır. Veri analizi, katılımcıların istatistikte düşük düzeyle orta düzey arası öz-yeterlik inançlarına sahip olduklarını göstermiştir. Makalede, düşük öz-yeterlik inancına sahip öğretmen adaylarının istatistik kavramlarının öğretiminde karşılaştıkları zorluklar tartışılmakta, öğretim içeriği ve öğretim çevresine yönelik çözüm önerileri paylaşılmaktadır.

Anahtar kelimeler: istatistik eğitimi, öğretmen eğitimi, öz-yeterlik.

[*] Corresponding *Author*: Assoc. Prof. Dr., Marmara University, İstanbul, Turkey, eaydin@marmara.edu.tr, https://orcid.org/0000-0003-4298-2623
[**] Assoc. Prof. Dr., Gaziosmanpaşa University, Tokat, Turkey, eyup.sevimli@gop.edu.tr, https://orcid.org/0000-0002-2083-688X
[***] Student, Marmara University, İstanbul, Turkey, saja_abed@hotmail.com, https://orcid.org/0000-0002-9460-1303

Citation Information
Aydın, E., Sevimli E., & Abed, S. (2019). Statistical self-efficacy beliefs among pre-service mathematics teachers: The case of Palestine. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 12*(4), 1209-1222.

ISSN: 1308-1659

Introduction

Teachers of mathematics have responsibilities to make their students ready for solving the problems faced in their work and outside-work environments. Statistics is concerned in collecting, presenting, analyzing and interpreting data using tools such as numbers, tables, graphics and formulas (Bryman & Cramer, 2011). It has great effects on other branches of science (Jolliffe, 1976). Discussions on international platforms have shown that statistics, as well as basic mathematics education, is another important issue (Garfield & Ben-Zvi, 2008). Over the past 50 years, statistics have become a subject of increased emphasis in everyday life and work environments. It is an important issue nowadays that data about human behavior is collected and used as data sets, especially with the use of technology. In a society that is so much based on handling data every person in life needs to develop statistical skills. Hence, the ability to collect, analyze and interpret data will become a highly sought after skill in business life over the next decade. Statistics education topics have been included in curricula of many countries over the last 30 years. In addition, some countries (e.g., USA and UK) have begun to give more importance to statistical literacy in secondary and high school teaching objectives in the last decade. In the two reports published by American Statistical Association for undergraduate and graduate statistics education, i.e. "Guidelines for Assessment and Instruction in Statistics Education" (GAISE), the emphasis is on the importance of statistical thinking as a problem-solving and decision-making process, focusing on concepts and using real data, contexts and technology integration in the process (GAISE, 2005; GAISE, 2016). When researches on statistics education are examined, various studies about the effect of different teaching approaches (e.g., project based learning, technology based learning, etc.) on statistical literacy and the development of statistical thinking levels are encountered (GAISE, 2005; Garfield & Ben-Zvi, 2008; Joliffe, 1976; Koparan & Güven, 2013; Sevimli & Aydın, 2017). It is also necessary to examine the process of learning statistical concepts cognitively and to evaluate the difficulties experienced in statistical subjects in relation to affective factors. There are many sources for the difficulties of statistical education from the pedagogical aspects. Some of the difficulties mentioned in the related literature are presentation of the statistics contents with formula-based approaches, which are interrelated with daily life, and beliefs about the teaching and learning of statistics in the affective domain (Sevimli & Aydın, 2017).

In order to obtain effective results in the learning and teaching process, attention should be paid to the affective domain competencies of the learners and teachers as well as their cognitive competencies (e.g., self-judgment for thinking about completing a task). In this context, attitude, belief, anxiety and self-efficacy are among the affective domain competencies that receive attention (Peker, 2016; Ural, 2015). People with high self-efficacy have a high ability to face the challenges and perform the necessary skills to overcome them (Bandura, 2001). Students judge their efficacy for learning as a function of mental effort needed (Salomon, 1984). An individual with high level of self-efficacy is different in his way of thinking, emotional response and selecting activities from other people who has less self-efficacy (Çoban & Sanalan, 2002). A person with high self-efficacy has the ability to rearrange the surrounding circumstances to be successful in spite of the social, psychological or physical difficulties. A teacher gains self-efficacy from daily classroom activities. Self-efficacy increases with

experience that gained from teaching years and skills (Wolters & Daugherty, 2007), as a result, teacher's self-efficacy becomes stable once it is established (Bandura, 1997).

Self-efficacy in a mathematics classroom emerges from three elements: self-efficacy in solving mathematics problems, self-efficacy of being successful in classroom mathematics, and self-efficacy in using daily math calculations properly (Pajares & Miller, 1994). Students need to feel that their teachers' knowledge of and self-confidence in the subject are satisfactory (Skaalvik & Skaalvik, 2007). That way, they would accept the knowledge given by their teacher. A low self-efficacy might also lead to a low teaching performance, which in turn results in poor conceptual understanding in students. Moreover, high self-efficacy of mathematics teachers can have an influence on reducing students' misunderstandings (Peker, Erol, & Gültekin, 2018). In spite of the epistemic differences between mathematics and statistics (Rodgers, 2010), scientific knowledge gathered about self-efficacy in mathematics can be used in the area of statistics. There is not much domain specific knowledge about the sources for low self-efficacy in statistics. For instance, evidence suggests that low self-efficacy is an important problem also in statistics especially when solving problems (Hall & Vance, 2010; Onwuegbuzie & Wilson, 2003). Assessment of understanding and measurement of performance in a school subject is a difficult task. In the assessment of understanding of mathematical concepts, there always are loss of information even during the most effective form of teacher-learner interaction. In classroom conditions, it is even more difficult. Similar problem exists in the case of measurements of problem solving and quantitative reasoning skills. The discrepancy between levels of learning based on learners' own accounts and teachers' assessments can be ignorable in actual practice. Hence, self-efficacy presents an opportunity for the obtainment of indirect data about the existence and level of understanding and/or performance in a given concept/task.

The Palestinian Educational Context

The review of research literature in mathematics teaching and learning by trying variety of keywords including 'self-efficacy', 'conceptual understanding and 'assessment' gave little to nothing. It is important to state that there is a shortage of documented knowledge regarding the educational issues in Palestine. The knowledge that was gathered by the authors, about the statistics education in the country are based on the experiences of the third author. There are a total of 15 universities in The West Bank and Gaza Strip, almost all of which have faculties of education. The teacher training programs in Palestine are available in faculties of education. The three of them contain programs that give a bachelor's degree for mathematics teaching (i.e. Al-Quds University, Al-Quds-Open University and An-Najah University). One of the programs is a distance education program named as "Mathematics and its Teaching Methods" which is available in the Faculty of Educational Sciences of Al-Quds Open University. All of these are four year programs and graduates of these programs are considered eligible for being a mathematics teacher in the state schools.

The first time Palestinian students face statistical concepts is in the ninth and tenth grades. The learning units in the high school cover the introductory concepts including the measures of central tendency and measures of central discrepancy. In the first year of the university education in Palestine, there is a common course called the

introduction for statistics, which is obligatory in most of STEM and some of non-STEM areas including science, medicine, business, economics and mathematics. The aim of this course varies according to the needs of the area, but in general aim is making students reach a satisfactory level of statistical competence. Medical students, for example; have a biostatistics course which allows them to be able use statistics in their practices in medicine. In the undergraduate programs in economy and engineering have more than one course in their curricula. In the area of mathematics and its education, there is an introductory statistics course in the first semester and there is an advanced course in statistics and probability in later semesters. The weight of this course is on probability for the pure mathematics majors and is on statistics for the applied mathematics majors. There is also one graduate pure statistics program in a state Palestinian university, i.e. An-Najah University. There is only one mathematics teacher training program in Palestine which contains one course in statistics, which covers the introductory concepts. This content of this course is similar to the educational statistics course in the teacher training programs in Turkey.

Theoretical Framework

Self-efficacy is one of the key concepts that are subject to Bandura's (1977) social learning theory. According to the social cognitive theory, learning of students directly correlates to the observation of their teachers in the classroom (Vygotsky, 1978). In this respect, self-efficacy among teachers is very important in the teaching system as students trust the information delivered by the teacher. Self-efficacy is a measure of how long someone can persevere to achieve a planned target (Bandura, 1997). According to Schunk (1991), self-efficacy is individuals' judgment of their ability to perform a given skill. Self- efficacy is to be ready to do the required activities and well measured skills to accomplish a task (Pajares & Kranzler, 1995).

As it is difficult to predict performance in a given area (due to difficulties in accurately measuring performance), motivational variables such as self-efficacy proved to be very useful in predicting the performance in that area. There have been arguments about the efficiency of the construct in general areas (e.g. self-efficacy in teaching mathematics) (Finney & Schraw, 2003). Such an approach can be ineffective if the area under study has a high degree of specificity (Pajares, 1996). For example, 'teaching mathematics' is a wide construct which is composed of many sub-constructs (Schulman, 1987) that cannot be measured with a few scale items. In a domain-specific context such as statistics, there is a need for the contextualization of the self-efficacy judgments (Pajares, 1996). It is not a proper strategy to adapt a mathematics self-efficacy scale to obtain a statistical self-efficacy scale for two reasons: Firstly, statistics and mathematics are epistemologically different in that statistics deals with uncertainties as opposed to mathematics. Secondly, statistics has wide a range of concepts each needs to be dealt with separately.

In this study, as a result, for the operational definition of statistical self-efficacy beliefs, we decided to adapt Bandura's (1986) definition (cited in Başpınar & Peker, 2016) to define self-efficacy as 'predispositions of people about their own capacities to organize and apply the activities for the accomplishment of a statistical task".

Aim of the Study

Any data about the Palestinian education is valuable as there is so little research in the literature about the educational research done about Palestinian educational system. There are also almost no studies in the field of mathematics education as indicated by the national (Libraries of An-Najah, Al-Quds, Beirzeit and Al-Quds Open Universities) and international databases. Naturally, there is no study about cognitive and affective dimensions of mathematics education (e.g. statistical understanding, self-efficacy, and mathematics or statistics self-efficacy). The general focus of the study is the learning of statistics. Statistics is an important element of the training program for students in psychology, engineering, education and other STEM and some non-STEM areas. Moreover, there is evidence that statistical misconceptions are a major problem among pre-service teachers (Sevimli, 2010). Hence we think that low self-efficacy is worth examining as a potential source for misconceptions in pre-service teachers.

The curricular emphasis on probability and data analysis is increasing over the last two decades. Statistics is an area of knowledge that stands out in terms of skills in the 21st century. It is expected that 21st century statistical literacy will be a major skill (Rumsey, 2002). To be able to educate the individuals who have advanced skills in statistics for the next generation, it is important that the mathematics teacher candidates have the necessary knowledge base for statistics. This study is important because it focuses on a topic that gains interest (i.e. statistics) in a region where educational research is limited. Under the light of these issues, in this study, researchers aimed to measure the current self-efficacy levels of Palestinian pre-service teachers. Because one of the important components of statistical literacy is statistical self-efficacy, we specially focused on Palestinian teacher candidates' self-efficacy levels, which is a potential indicator of their performance in statistics. The study problem can be explained by the following research question:

- What are the Palestinian pre-service mathematics teachers' self-efficacy levels in statistics?

Methodology

This section explains the research design, data collection method, population, sample, study instruments and the statistical analysis methods that were applied to get the results of the study. In this research a quantitative paradigm was chosen which is based on the positive verification of the results that gained from the scientific experiences. The aim of this study is to measure the levels of self-efficacy of pre-service mathematics teachers. For the purpose of an inquiry, a commonly used classification distinguishes between exploratory, descriptive, and explanatory (Robson, 1993, p.42). Descriptive and explanatory purposes predominate in this study. When designing an inquiry, it is also important to have a strategy. In this study survey was the data collection strategy.

Participants

The population of this study was a group of pre-service mathematics teachers in the Palestinian universities. In order not to cause bias in choosing the sample of the study, a systematic random sampling was made: students were chosen randomly from two Palestinian universities according to their identity cards, the students who were

selected are the ones who had odd numbers in the last digit in their identity cards. This method allows us to select students randomly and each student had the equal probability of being chosen. The sample of this study was the pre-service mathematics teachers who finished their courses in statistics. The sample of the study consists of two parts: first part consists of a randomly selected 40 pre-service mathematics teachers as individuals who were involved in the calibration of the self-efficacy scale. The second part of the sample consists of another 100 pre-service mathematics teachers who were also randomly selected from the same universities. These teachers were examined using the self-efficacy scale.

Data Collection Tool

There have been many efforts to measure academic self-efficacy levels in different areas (Aydin & Sevimli, 2019; Bong, 1998; Holden, Barker, Meenaghan, & Rosenberg, 1999, Schunk & Pajares, 2005; Silver, Smith, & Greene, 2001; Sevimli & Aydın, 2017). In statistics the internationally known self-efficacy measuring instrument was developed by Finney and Schraw (2003). The questionnaire, developed by Finney and Schraw (2003), adapted to the different languages and their results in different cultures were shared in the related literature.

The aim of this study is to investigate self-efficacy levels of Palestinian pre-service mathematics teachers. In order to do that, there is need for a self-efficacy scale to be used in the Palestinian context. Hence, we measured the self-efficacy levels by using an efficacy scale which was adapted from its original English version. Hence the aim of the study is to measure the level of statistical self-efficacy levels of Palestinian pre-service mathematics teachers. Due to the arguments stated in the theoretical framework section, we preferred to use an instrument for measuring statistical self-efficacy that uses a domain-specific approach. Current Statistics Self-Efficacy Scale (CSSE) is a 14 items instrument which was developed by Finney and Schraw (2003) was positively correlated to mathematics self-efficacy and attitudes towards statistics (see Appendix A for CSSE items). The items of CSSE are content-specific. That is, they are not adaptations from a mathematics self-efficacy instrument. Each of its items are about the different concepts and skills about doing statistics. In the instrument, a six-point Likert scale ranging from “no confidence” at all to “complete confidence” was used for all items.

Validity and Reliability

In the present study we report findings from the Statistical Self-Efficacy questionnaire. This questionnaire is based on a six-point Likert type scale which contains 14 items. The reliability of the original questionnaire had an internal reliability value of 0.91 (Finney & Schraw, 2003). To be able to use the instrument in a sample different from the original one, it is important to calibrate it, that is, to ensure that it has satisfactory reliability and validity values. The value of 0.80 of the present instrument satisfies the reliability condition (Kline, 1999). In order to measure the validity of the CSSE the KMO and Bartlett’s methods for the confirmatory factor analysis were used which verified the 2-factor structure of the original instrument.

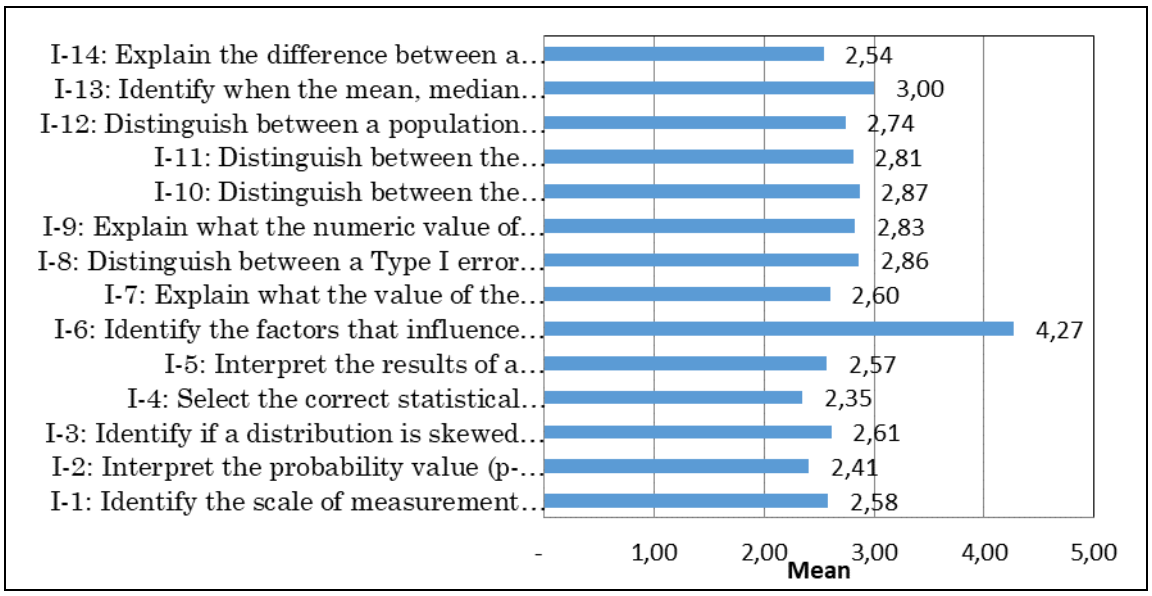
Data Analysis

The CSSE applied to the study group was transferred to a statistical program and analyzed in terms of the score average of each item, the degree of difficulty according to the items, and the level of success of the test (Low, Moderate, and High). While the relative evaluation was made according to the academic achievement, a standard deviation score was added and subtracted to the mean and three groups were formed (James, Witten, Hastie, & Tibshirani, 2014). To investigate the research question a descriptive analysis was made which involves the calculation of frequencies and percentages.

Results

The distributions of the findings obtained from the CSSE according to the mean results of each items are presented in Figure 1. The mean score for the whole test is 2.78 showing a mediocre self-efficacy towards statistics. The result of the analysis as shown in Figure 1 also indicates that I-4 "selecting the correct statistical procedure" had the lowest self-efficacy score among the items with a value of 2.35. This item measures if a student have the enough self-efficacy in his statistical knowledge about statistical hypothesis tests such as: t-test, z-test, paired comparison t-test and other statistical tests and also measures his self-efficacy to differentiate between those tests and the fields in which they can be applied. On contrast, I-6 "factors that influence statistical power" is the item on which participants show the highest self-efficacy (4.27). According to the given answers to the CSSE, the total score for the mean has been calculated and it was 2.79 and the total score for the standard deviation is 1.04 (see Appendix B for total mean and standard deviation scores). The one following the highest score is in the item concerning the uses of the measures of central tendency (3.00). The gap between the first and second highest items is quite big (1.27= 4.27-3.00).

Figure 1. Mean Results of the CSSE



The results showed that the first point (no confidence at all) had a frequency of (186) with a percentage of 13.3% of the total answers. Sixth point (complete

confidence) had a frequency of 30 with a percentage of 2.2% of the total answers which was the lowest percentage as shown in Table 1. The table also shows that the second point (a little confidence) obtained the highest frequency with a value of 441 and a percentage of 31.5% of the total answers.

Table 1

Results of the CSSE Analysis

	1	*2*	*3*	*4*	*5*	*6*
	NC[1]					*CC*[2]
Frequency	*186*	*441*	*411*	*237*	*95*	*30*
%	*13.3*	*31.5*	*29.3*	*16.9*	*6.8*	*2.2*

[1] No confidence

[2] Complete confidence

As the questionnaire consists of 14 items for all items a six-point Likert scale ranging from 1 to 6, so the highest score that can be obtained is 84 and the lowest score is 14. For this study sample the highest obtained score was 47 which is a mediocre score, and the lowest score was 28 which is a low score. Table 2 shows frequencies and percentages for participants' scores separated into intervals ranging from 14 to 84. When determining the success levels in the test, positioning according to the average in the normal distribution curve is taken as a reference (James, Witten, Hastie & Tibshirani, 2014). Scores between 14 and 37 are considered to be low, scores between 38 and 61 are considered to be moderate, and scores between 62 and 84 are considered to be high.

Table 2

Participants' Scores in the CSSE

Interval		*f*	*%*
14 –37	Low	*35*	*35*
38 –61	Moderate	*65*	*65*
62 –84	High	*00*	*00*

As shown in Table 2, 35% of the students' scores are ranging between 14 and 37, and the remaining scores are ranging between 38 and 61 with a percentage of 65%. The results also show that there are no scores more than 62 which mean that the Palestinian pre-service mathematics teachers' self-efficacy level is moderate in statistic course. Hence, 65% of the participants had mediocre and 35% of the participants had low self-efficacy scores.

Discussion and Conclusions

The present study reports on the self-efficacy levels of the pre-service Palestinian mathematics teachers in statistics. Results obtained from this study can form a basis to understand the psychological barriers regarding the learning of statistical concepts. The findings of this study, suggested overall that Palestinian pre-service mathematics teachers do not have high self-efficacy in statistics. There is no participant who scored within the high self-efficacy range (Table 2). Highest possible CSSE score is 84 and the highest score in this study is 42. This score is much below the Sevimli and Aydın (2017) and Finney and Schraw (2003) studies. The concepts which are thought to have an effect on the low self-efficacy scores of the participants are as follows; *i)* deficiencies related to content knowledge, *ii)* attitudes of teachers related to the importance of statistical learning-teaching and *iii)* the place of statistical concepts in related education policies. In terms of content knowledge; the highest self-efficacy of the Palestinian teacher candidates is obtained in the item concerning the meaning of statistical power. Statistical power is a concept explaining the real effect of the independent variable on the dependent variable in a statistical experiment (Pagano, 2012). This is surprising because, this concept is generally perceived as a difficult one by the students (Huck, 2011). Moreover, in the American (Finney & Schraw, 2003) and the Turkish (Sevimli & Aydın, 2017) samples, the score of the item is below the scale average in both studies. When teachers' attitudes on statistics and its place in the education system are taken into consideration, it is seen that data processing concept is included in the mathematics program as a beginning statistical subjects from 9^{th} grade onwards, and the statistics courses are given in the teacher training program. The inclusion of statistical topics in the upper classes and the limited content of the curriculum could have influenced teachers' beliefs about statistical self-efficacy. Leaving aside the political conditions that the country is living in, and concentrating on the educational concerns, it is possible to say that there seems to be important problems to deal with.

According to Koparan and Güven's (2013) study results, students at secondary school level; do not have enough knowledge in statistical subjects, especially in organizing and reducing the data, data analysis and data interpretation. One of the facts supporting the concept of self-efficacy is the content knowledge, and for improving teachers' self-efficacy beliefs it is suggested that statistical contents should be included in the program from the previous levels of education. Besides, Teacher attitudes and beliefs are shown as one of the sources that cause the inadequacies and difficulties of the students in the related literature (GAISE, 2016; Pajares & Miller, 1994). From this point of view, it is thought that the arrangements to be made in teacher education programs can be effected achievements of students in the statistics course, indirectly. Teachers plays a critical role in directing and motivating students to use their skills in solving mathematical problems and in offering them the educational environment that they need to achieve the supposed educational goals from the educational process. Palestinian teachers in general do not have the persistent attitude to direct and motivate their students to achieve the required goals in their mathematics teaching. Those factors could be determining factors of students' levels of education in the mathematics classroom. While the study considers the statistical self-efficacy beliefs of the teachers, they did not provide any comparisons in terms of student and program content.

Investigating the role of these factors on the education system we need further studies. In some studies, it is stated that there may be differences between self-efficacy beliefs and academic achievements related to subjects in the statistical course as it does not require performance within the self-efficacy concept (Sevimli, 2010). Therefore, to give meaning to the findings regarding statistical self-efficacy, it is necessary to link them to the studies concerning performance in this area.

References

Aydin, E., & Sevimli, N. E. (2019). An investigation of preservice mathematics teachers' self-efficacy beliefs and attitudes toward statistics. *İstanbul Sabahattin Zaim Üniversitesi Eğitim Fakültesi Dergisi [IZU Journal of Education]*, *1*(2). [Accepted for publication]

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review*, *84*(2), 191-215.

Bandura, A. (1986). The explanatory and predictive scope of self-efficacy theory. *Journal of Clinical and Social Psychology*, *4*, 359-373.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. NY: W. H. Freeman and Company.

Bandura, A. (2001). Social cognitive theory: An agentic department of psychology, Standford University. *Annual Review of Psychology*, *52*, 1–26.

Başpınar, K., & Peker, M. (2016). The relationship between pre-service primary school teachers' mathematics teaching anxiety and their beliefs about teaching and learning mathematics. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science]*, *9*(1), 1-14.

Bong, M. M. (1998). Self-efficacy and self-regulated learning: The implication of research related in education engineering. *Journal of Educational Technology*, *14*(1), 97-118.

Bryman, A., & Cramer, D. (2011) Q*uantitative data analysis with IBM SPSS statistics 17, 18 and 19: A guide for social scientists.* Psychology Press.

Çoban, T. A., & Sanalan, V. A. (2002). Fen bilgisi öğretimi dersinde özgün deney tasarım sürecinin öğretmen adayının öz yeterlilik algısına etkisi. [*Erzincan Üniversitesi Eğitim Fakültesi Dergisi [Erzincan University Journal of Education Faculty*] *4*(2), 1-10.

Finney, S., & Schraw, G. (2003). Self-efficacy beliefs in college statistics courses. *Contemporary Educational Psychology*, *28*, 161–186.

GAISE (2005). *Guidelines for assessment and instruction in statistics education (GAISE) report: A curriculum framework for Pre K–12 statistics education.* The American Statistical Association (ASA). Retrieved from: http://www.amstat.org/education/gaise/

GAISE (2016). *Guidelines for assessment and instruction in statistics education college report 20/6.* American Statistical Association (ASA). Retrieved from: http://www.amstad.org/asa/files/pdfs/GAISR/GaiseCollegc.Full.pdf.

Garfield, J. B., & Ben-Zvi, D. (2008). *Developing Students' Statistical Reasoning: Connecting Research and Teaching Practice*. Springer Publishers.

Hall, S., & Vance; EA (2010). Improving self-efficacy in statistics: Role of self-explanation and feedback. *Journal of Statistics Education, 18*(3), 1-21.

Holden, G., Barker, K., Meenaghan, T., & Rosenberg, G. (1999). Research self-efficacy: A new possibility for educational outcomes assessment. *Journal of Social Work Education, 3*, 463-476.

Huck. S. W. (2011). *Reading statistics and research* (6th Ed). New York: Pearson.

James, G., Witten, D., Hastie, T., & Tibshirani, R. (2014). *An introduction to statistical learning: with application in R*. New York: Springer.

Joliffe, F. R. (1976). A continuous assessment scheme for statistics courses for social scientists. International *Journal of Mathematics Education in Science and Technology*, *7*, 97-103.

Kline, P. (1999). *The handbook of psychological testing* (2nd ed). London: Routledge.

Koparan, T., & Güven, B. (2013). Proje tabanlı öğrenme yaklaşımının ilköğretim 8. sınıf öğrencilerinin örneklem kavramına yönelik istatistiksel okuryazarlık seviyelerine etkisi. *Eğitim ve Öğretim Araştırmaları Dergisi*, *2*(1), 185–196.

Onwuegbuzie, A. J., & Wilson, V. (2003), Statistics anxiety: Nature, etiology, antecedents, effects, and treatments-a comprehensive review of the literature. *Teaching in Higher Education*, *8*(2), 195-209.

Pagano, R. R. (2012). *Understanding statistics in the behavioral sciences* (10th Edition). United Kingdom: Wadsworth Publishing.

Pajares, F. (1996). Self-efficacy beliefs and mathematical problem-solving in gifted students. *Contemporary Educational Psychology*, *21*, 325–344.

Pajares, *F., & Kranzler, J. (1995). Self-efficacy beliefs and general mental-ability in mathematical problem-solving. Contemporary Educational Psychology, 20*(4), *426–443.*

Pajares, F., & Miller, M. D. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem-solving: A path analysis. *Journal of Educational Psychology*, *86*(2), 193–203.

Peker, M. (2016). Mathematics teaching anxiety and self-efficacy beliefs toward mathematics teaching: A path analysis. *Educational Research and Review*, *11*(3), 97-104.

Peker, M., Erol, R., Gültekin, M. (2018). Investigation of the teacher self-efficacy beliefs of math teachers. *Malaysian Online Journal of Educational Sciences*, *6*(4), 1-11.

Robson, C. (1993). *Real world research. A resource for social scientists and practitioner-researchers*. Oxford: Blackwell.

Rodgers, J. (2010). The epistemology of mathematical and statistical modeling: A quiet methodological revolution. *American Psychologist*, *65*, 1-12.

Rumsey, J. (2002). Statistical literacy as a goal for introductory statistics courses. *Journal of Statistics Education*, *10*(3), 21-36.

Salomon, G. (1984). Television is "easy" and print is "tough": The differential investment of mental effort in learning as a function of perceptions and attributions. *Journal of Educational Psychology*, *76*(4), 647-658.

Schunk, D. H., (1991). Self-efficacy and academic motivation. *Education Psychologist*, *26*, 207-231.

Schunk, D. H., & Pajares, F. (2005). *Competence perceptions and academic functioning*. In A. J. Elliot & C. S. Dweck (Eds.), Handbook of competence and motivation (pp. 85-104). Guilford Press, New York.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57,* 1-22.

Sevimli, N. E. (2010) *Matematik öğretmen adaylarının istatistik dersi konularındaki kavram yanılgıları; İstatistik dersine yönelik özyeterlik inançları ve tutumlarının incelenmesi*. Yüksek Lisans Tezi, Marmara Üniversitesi, İstanbul, Türkiye.

Sevimli, N., & Aydın, E. (2017). İstatistik öz yeterlilik inanç ölçeğinin Türkiye örneklemine uyarlanması. *Eğitim ve İnsani Bilimler Dergisi: Teori ve Uygulama, 8*(16), 44-57. Retrieved from http://dergipark.gov.tr/eibd/issue/ 33396/371608

Skaalvik, E. M., & Skaalvik, S. (2007). Dimensions of teacher self-efficacy and relations with strain factors, perceived collective teacher efficacy, and teacher burnout. *Journal of Educational Psychology, 99,* 611–625.

Silver, B. B., Smith, E. V., & Greene, B. A. (2001). A study strategies self-efficacy instrument for use with community college students. *Educational and Psychological Measurement, 61*(5), 849-865.

Ural, A. (2015). Matematik öz-yeterlik algısının matematik öğretmeye yönelik kaygıya etkisi. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 8*(2), 173-184.

Vygotsky, L. S. (1978). Mind in society: *The development of higher psychological processes.* London: Harvard University Press.

Wolters, C. A., & Daugherty, S. G. (2007). Goal structures and teachers' sense of efficacy: Their relation and association to teaching experience and academic level. *Journal of Educational Psychology, 99*(1), 181-193.

Appendix A

Current Statistics Self-Efficacy Scale						
	NC[1]					CC[2]
I-1. Identify the scale of measurement for a variable	1	2	3	4	5	6
I-2: Interpret the probability value (p-value) from a statistical procedure.	1	2	3	4	5	6
I-3: Identify if a distribution is skewed when given the values of three measures of central tendency	1	2	3	4	5	6
I-4: Select the correct statistical procedure to be used to answer a research question.	1	2	3	4	5	6
I-5: Interpret the results of a statistical procedure in terms of the research question.	1	2	3	4	5	6
I-6: Identify the factors that influence power.	1	2	3	4	5	6
I-7: Explain what the value of the standard deviation means in terms of the variable being measured.	1	2	3	4	5	6
I-8: Distinguish between a Type I error and a Type II error in hypothesis testing.	1	2	3	4	5	6
I-9: Explain what the numeric value of the standard error is measuring	1	2	3	4	5	6
I-10: Distinguish between the objectives of descriptive versus inferential statistical procedures.	1	2	3	4	5	6
I-11: Distinguish between the information given by the three measures of central tendency.	1	2	3	4	5	6
I-12: Distinguish between a population parameter and a sample statistic	1	2	3	4	5	6
I-13: Identify when the mean, median and mode should be used as a measure of central tendency.	1	2	3	4	5	6
I-14: Explain the difference between a sampling distribution and a population distribution.	1	2	3	4	5	6

[1] *Noconfidence*
[2] *Complete confidence*

Appendix B

Descriptive Analysis of the CSSE									
Item Number	Min	Max	Mean	SD	Item Number	Min	Max	Mean	SD
1	1	6	2.58	1.13	8	1	6	2.86	1.17
2	1	5	2.41	1.16	9	1	6	2.83	1.23
3	1	5	2.61	.87	10	1	6	2.87	1.36
4	1	5	2.35	1.18	11	1	4	2.81	.84
5	1	5	2.57	1.08	12	1	5	2.74	.93
6	1	6	4.27	1.13	13	1	6	3.00	.31
7	1	5	2.60	1.12	14	1	5	2.54	.99
							Total	2.78	1.03

Journal of Theoretical Educational Science, 12(4), 1223-1238, October 2019
Kuramsal Eğitimbilim Dergisi, 12(4), 1223-1238, Ekim 2019
[Online]: https://dergipark.org.tr/akukeg
DOI number: http://dx.doi.org/10.30831/akukeg.458061

School Administrators' Opinions on Professional Values and Professional Skills Required To Be Gained to Classroom Teachers In-Service Training Process*

Okul Müdürlerinin Sınıf Öğretmenlerine Hizmetiçi Eğitim Sürecinde Kazandırılması Gereken Mesleki Değerler ve Mesleki Becerilere İlişkin Görüşleri

Şenol SEZER** **Nermin KARABACAK*****
İsa KORKMAZ**** **Mehmet KÜÇÜK*******

Received: 07 September 2018 **Research Article** **Accepted:** 26 October 2018

ABSTRACT: The purpose of this study is to examine the professional values and skills to be gained to classroom teachers in in-service training process. The research was designed in the qualitative case study model. The study group was 10 school administrators working in elementary schools in a Northeast Anatolia province of Turkey. The study group was determined by using criteria sampling method. The data were collected through a semi-structured interview form and analyzed by using content analysis and descriptive analysis techniques. 24 different values were determined should gain through in-service training to class teachers. Based on the results it can be suggested that the personal values should be given teachers through pre-service and in-service training. The professional skills should be gained teachers through in-service training including communication skills, technology using skills, pedagogical content knowledge, planning skills, material designing and using skills. In addition, the professional values such as cooperation, love of teaching profession, leadership, role-modeling, self-renewal, sacrifice and solidarity can be gained teachers through in-service training.

Keywords: classroom teacher, principal, professional values, professional skills, in-service training.

ÖZ: Bu çalışmanın amacı, sınıf öğretmenlerine hizmetiçi eğitim sürecinde kazandırılacak mesleki değerler ve becerilerin incelenmesidir. Araştırma, nitel durum çalışması modelinde tasarlanmıştır. Araştırma Kuzeydoğu Anadolu'da bir ilde görevli 10 okul yöneticisiyle gerçekleştirilmiştir. Araştırmanın çalışma grubu, ölçüt örnekleme ile belirlenmiştir. Araştırmanın verileri, yarı yapılandırılmış görüşme formuyla toplanmıştır. Veriler içerik analizi ve betimsel analiz teknikleriyle analiz edilmiştir. Sınıf öğretmenlerine hizmetiçi eğitim yoluyla kazandırılması gereken 24 değer belirlenmiştir. Araştırmanın sonuçlarına dayalı olarak öğretmenlere hizmet öncesi ve hizmet içi eğitim yoluyla kişisel değerler kazandırılması gerektiği önerilebilir. Öğretmenlere hizmet içi eğitimler yoluyla iletişim becerisi, teknoloji kullanma becerisi, alan bilgisi, planlama becerisi, materyal tasarlama ve kullanma becerisi kazandırılmalıdır. Ayrıca hizmet içi eğitimlerle öğretmenlere işbirliği, meslek sevgisi, liderlik, rol model olma, kendini yenileme, fedakârlık ve dayanışma gibi profesyonel beceriler kazandırılabilir.

Anahtar kelimeler: sınıf öğretmeni, okul müdürü, meslekî değerler, meslekî beceriler, hizmetiçi eğitim.

* This study is an extended form of the paper presented at the 4th International Congress on Curriculum and Instruction (ICCI) held in Antalya, Turkey on 27-30 October 2016.

** *Corresponding Author:* Assoc. Prof. Dr. Ordu University, Ordu, Turkey, senolsezer@odu.edu.tr, https://orcid.org/0000-0001-8800-6017
*** Assist. Prof. Dr., Recep Tayyip Erdoğan University, Rize, Turkey, nerminkarabacak@gmail.com, https://orcid.org/0000-0001-5231-1730
**** Prof. Dr. Necmettin Erbakan University, Konya, Turkey, ikorkmaz@konya.edu.tr, https://orcid.org/0000-0002-6647-1812
***** Prof. Dr. Recep Tayyip Erdoğan University, Rize, Turkey, mehmet.kucuk@erdogan.edu.tr, https://orcid.org/0000-0001-5910-4099

Citation Information
Sezer, Ş., Karabacak, N., Korkmaz, İ., & Küçük, M. (2019). School administrators' opinions on professional values and professional skills required to be gained to classroom teachers in-service training process. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 12*(4), 1223-1238.

ISSN: 1308-1659

Introduction

M. Kemal Atatürk said: 'Those who save the nations are lonely and only the teachers.' He emphasized by saying 'A people, being deprived of a teacher, has not obtained yet to be a nation' the place and the importance of the teacher to create a civilized nation (Aytaç, 1997, p. 112). Mümtaz Turhan (2010) said 'There is no other element in an educational institution that can hold the place of a good teacher' thence underlined the importance of the teacher for an education system. The contribution of the teacher cannot be denied via the education which transform the perception of 'me' into the perception of 'we'. As a natural consequence to understand the importance of teachers in the functioning and social transformation of education system, teacher's education is at the center of the education system. Consequently, in recent years it was seen that educational politicians and specialists are more concentrated on teacher education, values and professional values.

Professional values are the standard rules and principles determining the professional attitudes and behaviors for the members of a profession which they should exhibit. The basic feature of these standard rules is to reveal the necessity to behave accordingly by the persons in the profession to the principles of behavior that are professionally demanded in relation between interpersonal relationships and in face of the events and facts (Aydın, 2013; Karabacak, 2016). Professional value, from the point of teachers can be defined as the whole of the professional roles and responsibilities that must be exhibited in communication with the stakeholders while the teaching profession is being carried out. Nowadays, the responsibility to transfer social values to the next generations is largely fulfilled by the teachers (Akyüz, 2012). That's why teachers' professional values became subject of many studies. Based on research findings, the professional values that classroom teachers should possess can be summarized as follows: continuous improvement, responsibility, awareness, role modeling, solidarity, organizational commitment, profession love, student recognition and student-centeredness, create a safe and democratic learning environment, integrate learners into real life, make students happy, holistic assessment, follow up, effective communication skills and cooperation (Aydın, 2013; Karabacak, Küçük, & Korkmaz, 2015; Karabacak, 2016; Klis & Kossewska, 1996; Milli Eğitim Bakanlığı [MEB], 2008; National Education Association [NEA], 1975; Richardson & Watt, 2006; Tunca, 2012; Vidovic & Velkovski, 2013).

The knowledge, skills, attitudes and values gained students by teachers in primary schools are very important in terms of to becoming an individual the base of an adult's life. That's why, primary school teaching, it differs from all other teaching areas in addition to having a special place in teaching areas. Primary school teaching defined as a versatile profession in terms of knowledge and skills (Karabacak, Küçük, & Korkmaz, 2015; Richardson & Watt, 2006). Professional values of Primary school teachers, not only concern themselves but also the students, student's parents and the society. The survey results, reveal that teachers in Turkey not having the necessary professional values have negative effects on the teachers and their joint owners (Altınkurt & Yılmaz, 2011; Pelit & Güçer, 2006; Yılmaz & Altınkurt, 2009). In addition, although it was aimed to gain professional values in pre-service training

period, the results from research show that the aims was not met in service training (Boydak-Özan, Şener, & Polat, 2014; Uştu, Taş, & Sever, 2016).

The golden rule to raise a teacher standard is to assure the professional development that will continue throughout the professional life. In a country without reaching to the demanded level for teachers and teacher's profession, the availability of a good education system and educational objectives in that country, or the provision of high economic opportunities to teachers, cannot provide access to targeted information society (Ataünal, 2003). Because of the uprising of the standards concerning professional values and the new technology and the updating of the existing knowledge; in-service training -in terms of classroom teaching - which is an interdisciplinary field, became a fundamental obligation to acquire professional values. Bitan-Friedlander, Dreyfus and Milgrom (2004), underlines that in-service training is the most effective strategy in bringing professional values to teachers. However, in-service training, it is an important question how classroom teachers obtained knowledge, skills and values of the profession or how successful they could be. In interviews with school principals, it was observed that school principals complained that teachers were not adequately equipped in terms of professional values and professional skills. When the studies on this subject are examined, it is understood that this case has not been investigated in depth. In studies conducted at the years between 2000-2018 related to in-service training of the classroom teachers in Turkey, it has been found that these studies tried to define the needs of in-service training of classroom teachers (Bayındır, 2015; Budak & Demirel, 2003; EARGED, 2008; Gökmenoğlu, 2013; Karasu, Aykut, & Yılmaz, 2014; Şahin, 2013; Uçar, Başar, & Hamarat, 2007; Uşun & Cömert, 2013), and analysis and comparison of in-service trainings (Ayvacı, Bakırcı, & Yıldız, 2014; Gültekin & Çubukçu, 2008; Kıranlı & Yıldırım, 2014; Parmaksız & Kısakürek, 2013; Serin & Korkmaz, 2014; Pepeler, Murat, & Akmençe, 2016). In some limited researches, it has been found that the needs of in-service training of classroom teachers were different according to the opinions of themselves and school administrators (Kıranlı & Yıldırım, 2014; Paşa, 2002; Serin & Korkmaz, 2014). The results show that that limited researches were made related to the values of teaching profession and inadequate outputs were produced in service training. However, the fact that classroom teachers or the administrators do not consider the professional values as an important need or the activities in-service training are not scheduled to fulfill the cavity in this area, present a critical problem. The purpose of this study is to examine the professional values and professional skills to be gained to classroom teachers in in-service training process. For this purpose, the following questions were sought:

1. Which professional values do school administrators predict to be gained to classroom teachers through in service training?

2. Which professional skills do school administrators predict to be gained to classroom teachers through in-service training?

Method

Research Design

This study was designed in case study model which one of the qualitative research design. We make profit from the qualitative research design to obtain

comprehensive information on a subject (Denzin & Lincoln, 2005). The case study allows to do an investigation to describe the holistic and meaningful features of real life events. Researchers using this method have the opportunity to closely and profoundly review and interpret a given context in which the factors (environmental, individual, events, processes, etc.) of one or more of the factors (the environment, the individual, the events, the processes etc.) have influenced the situation in the holistic approach and how they have affected the situation (Creswell, 2015; Merriam, 2001; Yin, 2009). In this study, a holistic single case design was used. In single situation patterns, as the name implies, there is a single analysis unit (an individual, an institution, a program, a school, etc.).

Study Group

The study group of the research constitutes 10 primary school administrators working in primary schools affiliated to the Rize Provincial Directorate of Education in the academic year 2016-2017 and determined by criterion sampling method. The criteria sampling method requires the identification of individuals or groups meeting the specified criteria in the study. These criteria can be established by the investigator or a present criterion list can be used (Creswell, 2015; Merriam, 2001). The criterion to designate the study group are: (i) to work as a primary school teacher at least five years (ii) have and / or have completed a master's degree in the relevant field, (iii) have been employed as an executive or researcher in at least one project related to education, (vi) to work in different place of settlement. In this context, there is a necessity for school administrators to take both these values and to experience this profession so that the classroom teachers can define what professional values should be taught in service training. The survey was conducted on a voluntary basis. All administrators participated in this study are male. The professional seniority of participants varies from 9 to 35 years. The average occupational age is 19.6 years. Managerial seniority ranges from 3 to 25 years. Average managerial seniority is 9.5 years. Five of the participants are in the provincial center, two in the district, and three in the village school. Before the analysis process the participants were coded as P1, P2, P3…P10.

Data Collection Tool

Data were collected through a semi-structured interview form developed by the researchers. The interview form is prepared on the review of the relevant literature and the expert opinions. The semi-structured interview form consists of two parts. In the first part, there are four factual questions aiming to determine the participants' gender, professional seniority, managerial seniority and the school settlement center where they work. In the second part, there are two open ended questions. (1) Which professional values should be brought in through in service training for classroom teachers? (2) Which professional skills should be brought in through in service training for classroom teachers? The views of two academicians who are experts in the field of educational sciences were taken on the content and face validity of the semi-structured interview form. The experts in the field of educational sciences stated that the questions aiming to determine the in-service training requirements of classroom teachers and the benefits of in-service training should be excluded from the scope of the research. The opinions of two specialist academicians from the field of Turkish teaching license were taken on the

language validity of the semi-structured interview form. The semi-structured interview form was finalized in line with the opinions of field experts. An appointment was requested after preliminary information was given about the purpose of working on the basis of volunteering and the participant's approval was obtained. The semi-structured interviews planned by this way were realized in 20-30 minutes. Negotiations were recorded with voice recorder. The data collection process was supported by the note-taking method.

Data Analysis

Data were analyzed by content analysis technique. Sound recordings were converted into digital files for analysis. Following steps were applied in content analysis process in the direction of data obtained from voice recordings: (1) the coding of data, (2) generation of themes, (3) organization of codes and themes, and (4) identification and interpretation of findings. In the content analysis, the main themes were reached with axial (typological) coding from the views encoded in open coding. Codes related according to the similarities and differences were theming. It was checked whether the specified themes support all the data. The coding on the obtained data was performed separately by the researchers and three experts outside the faculty. After encoding, the correspondence between the encodings has been tested (Miles & Huberman, 1994).

Validity and Reliability

For the internal validity of studies: (i) the theoretical framework of the study has been established by conducting a comprehensive literature search on the subject, (ii) the data in the findings are interpreted according to the theme they belong to (iii) findings obtained after data analysis were presented without a comment (vi) expert opinion was applied in order to confirm whether the main-themes represent the coding sub-themes (Creswell, 2015; Neuman, 2013). For the expert opinion, two lists including the themes and the coded ones were given to the three faculty members in different state university in the field of value and class education. These lists were including four main themes and the related sub-themes. We asked from the experts to match four main themes with the sub-themes totally 29 themes without keeping out any coding and theme. To determine the reliability of coding 'Reliability= Agreement / (Agreement + Dissidence) × 100' formula was applied (Miles & Huberman, 1994, s. 64). For the views of the school administrators, the common agreement between the three coders was found as '26 / (26 + 3) ×100 = 89.6%'. The following processes were pursued in order to ensure the external validity of the work: in the method section, the analysis of the data based on the model of the research, the selection process of the study group, the data collection tool, interviews made are explained in depth. In the study, the research process, the analysis and interpretation of the data, are given simply and clearly. So readers could understand them easily.

Findings

In this section, the findings of the study related to the first sub-problem are given. The findings related to the professional values to be gained to the classroom teachers during in-service training are presented in a thematic order. In addition, to ensure a better understanding of the subject the more remarkable views were presented according to descriptive analysis results. For this purpose, the participants' views were

examined in detail and the opinions related to the universal values main theme were presented directly to provide a better understanding of the subject. These views are as follows:

> "Classroom teachers should have a deep human love. Because our material is human being." [P1].
>
> "Teachers should have a democratic attitude and respect people." [P2].
>
> "Teachers should be tolerant and respectful of differences." [P3].
>
> "Teachers must be fair, democratic and respect for human rights." [P4].
>
> "Teachers must have love for human beings and respect differences." [P6].
>
> "Teachers should internalize democratic values, respect for people." [P9].

In Table 1, the sub-themes related to the universal values main theme were presented.

Table 1

Sub-themes Related to the Universal Values Main Theme (N=10)

Sub-themes	*f*	*%*
Respecting people	6	25.0
Justice	5	20.8
Human love	5	20.8
Democratic attitude	3	12.5
Respecting differences	3	12.5
Tolerance	2	8.4
Total	24	100

In Table 1, the universal values to be gained to the classroom teachers are seen. These values are the respecting people (f=6, 25.5%), justice (f=5, 20.8%), human love (f=5, 20.8%), democratic attitude (f=3, 12.5%), respecting differences (f=3, 12.5%), and tolerance (f=2, 8.4%).

The participants' remarkable views related to the personal values main theme were presented directly to provide a better understanding of the subject. These views are as follows:

> "Teachers should be open to innovations, behave responsible. They also should research developments and innovations related to their profession and renew themselves by following them continuously." [P1].
>
> "Teachers should have empathy skills, be open to innovations and demonstrate entrepreneurial characteristics. They also should be creative and responsible." [P2].
>
> "A teacher must be open to innovation. Because life is changing so fast. I think you can't capture life if you're not open to innovation." [P3].
>
> "Teachers should give confidence to students. The teachers must also be diligent and versatile." [P4].
>
> "Teaching profession requires a great responsibility. Teachers should be behave consistent with what they say. In addition, teachers must have a vision." [P5].
>
> "The most important thing in the teaching profession is not to intimidate the child, to be aware of their abilities and to make you trust." [P6].

"Teachers should be impartial, be versatile, and be honest with students. Because that age children need to be a model, must be honest." [P7].

"Teachers should be aware of their duties and responsibilities. Teachers should be open to new information, not conservative, and open to learning." [P8].

"Teachers should have a high level of awareness and teachers should be sensitive to students' problems. They also need to be aware of their responsibilities." [P10].

In Table 2, the sub-themes related to the personal values main theme were presented.

Table 2

Sub-themes Related to the Personal Values Main Theme (N=10)

Sub-themes	f	%
Responsibility	5	20.0
Openness to innovation	5	20.0
Reliability	3	12.0
Creativity	3	12.0
Impartiality	2	8.0
Empathy skills	2	8.0
Vision	1	4.0
Awareness	1	4.0
Entrepreneurship	1	4.0
Diligence	1	4.0
Versatility	1	4.0
Total	25	100

In Table 2, it is seen the personal values to be gained to classroom teachers. These values are the responsibility (f=6, 20.0%), openness to innovation (f=5, 20.0%), reliability (f=3, 12.0%), creativity (f=3, 12.0%), impartiality (f=2, 8.0%), empathy skills (f=2, 8.0%), vision (f=1, 4.0%), awareness (f=1, 4.0%), entrepreneurship (f=1, 4.0%), diligence (f=1, 4.0%), versatility (f=1, 4.0%).

The participants' remarkable views related to the professional values main theme were presented directly to provide a better understanding of the subject. These views are as follows:

"Firstly, the class teachers should love the profession. They should also renew themselves continuously." [P2].

"Teachers should love their profession and dedicate themselves to the profession. They should also constantly renew themselves." [P3].

"Students take their teachers as models. They imitate teachers' speech, walk, and clothing. Classroom teachers should be a good leader in the classroom environment and a role-model for their students. Cooperation with both managers and teachers will reflect positively to their students." [P4].

"Whether it is a classroom teacher or a branch teacher, the first value that should be found in the teacher is to love the profession. The teacher, who considers the principle that the student does what he sees, should primarily be a role-model for his students." [P5].

> "It is definitely an important professional value for teachers to be in constant cooperation with their colleagues and parents. Teachers should also exhibit leadership characteristics. " [P6].
>
> "Parents should be able to support what the children learn at school. What students learn at home should also be supported by the teacher at school. There should be closer cooperation between teachers and parents." [P7].
>
> "Firstly, the teachers should love their profession. Collaboration gives teachers a great power to overcome the difficulties encountered. In addition, teachers should renew themselves and be a role model in all aspects for their students." [P8].
>
> "Teachers should exhibit leadership characteristics, be a role model for their students with their attitudes and behaviours, and be in cooperation and solidarity with their colleagues." [P9].
>
> "Teachers should be in constant cooperation with the school management, parents and senior institutions and should be open to cooperation." [P10].

In Table 3, the sub-themes related to the professional values main theme were presented.

Table 3

Sub-themes Related to the Professional Values Main Theme (N=10)

Sub-themes	f	%
Cooperation	6	25.0
Love of profession	5	20.7
Leadership	4	16.7
Role-modeling	4	16.7
Self-renewal	3	12.5
Self-sacrifice	1	4.2
Solidarity	1	4.2
Total	24	100

In Table 3, the professional values to be gained to the classroom teachers are seen. These values are the cooperation (f=6, 25.0%), love of profession (f=5, 20.7%), leadership (f=4, 16.7%), role-modeling (f=4, 16.7%), self-renewal (f=3, 12.5%), self-sacrifice (f=1, 4.2%), and solidarity (f=1, 4.2%).

In this section, the professional skills related to the second sub-problem of the study are given. The participants' remarkable views related to the professional skills main theme were presented directly to provide a better understanding of the subject. These views are as follows:

> "I think that the most important professional skills to be gained to teachers are communication skills. In addition, teachers should be given the contextual knowledge and the skills to use technology effectively." [P1].
>
> "I think that the basic professional skills to be gained to the teachers through in-service training is communication skills. In addition, teachers should be able to design and use materials, and to be able to use technology." [P2].
>
> "Firstly, the communication skills should be gained to teachers through in-service training. In addition, teachers should be given contextual knowledge and planning skills." [P3].

"The most important professional skills that should be gained through in-service training to teachers are effective communication skills. In addition, the ability to plan classroom activities should be gained." [P4].

"I believe that teaching is a profession that require specialty. I also see communication skills as a sine qua non of education." [P6].

"I think that the professional skills that the teacher should have in the first place are communication skills. I think that the professional skills that the teacher should have in the first place are communication skills. In addition, the teacher should have the ability to use technology effectively." [P7].

"I think that the basic professional skills that teachers should have are communication skills and contextual knowledge. In addition, teachers should be able to plan different activities." [P8].

"Teachers must have contextual knowledge. Teachers should use education technologies effectively. The ability to design and use materials should definitely be included in the professional skills of the teacher." [P9].

"I think that the communication skills are the most important professional skills to be gained to teachers." [P10].

In Table 4, the sub-themes related to the professional skills main theme were presented.

Table 4

Sub-themes Related to the Professional Skills Main Theme (N=10)

Sub-themes	f	%
Communication skills	10	37.0
Technology using skills	6	22.2
Contextual knowledge	5	18.5
Planning skills	4	14.8
Designing materials and using skills	2	7.5
Total	27	100

In Table 4, the professional skills to be given to classroom teachers are seen. These skills are the communication skills (f=10, 37.0%), technology using skills (f=6, 22.2%), contextual knowledge (f=5, 18.5%), planning skills (f=4, 14.8%), and designing materials and using skills (f=2, 7.5%).

Discussion and Conclusion

The purpose of this study was to examine the professional skills and professional values to be gained to classroom teachers in in-service training process according to the opinions of the school administrators. According to the views of school administrators, four main themes and 29 sub-themes were identified, and these main themes were universal values, personal values, professional values and professional skills. School principals express their view to bring in classroom teachers about the respect for human values, respect for justice, human love, democratic attitude, respect for differences, and tolerance within universal values. It can be said that it is a remarkable finding that according to school principals human respect and human love are more important than other values because teaching is a profession of love teachers who love children can

establish warm and positive relationships with them (Eskicumalı, 2002). Likewise, in the studies conducted by Downing, Ryndak and Clark (2000), Ergün and Özdaş (1999), the findings show that children love was the main condition of the teaching profession; Gündüz and Aktepe (2017) expressed that the main values for the primary class teachers were human respect and human love. In the studies conducted by Gündüz and Aktepe (2017), Işıktaş (2015), MEB (2008), Özcan and Polat (2016), Selvitopu, Bora and Taş, 2015, Vidovic and Velkovski (2013), it was stated that primary class teachers should have universal values such as 'justice', 'democratic attitude', 'respect for differences' and 'tolerance.' Similarly, in the studies conducted by Gündüz and Aktepe (2017), Karabacak (2016), Tunca (2012), Yeşiltaş-Doktaş and Mentiş-Taş (2016) it was stated that primary class teachers must first have universal values.

School principals state that the personal values such as responsibility, openness to innovation, reliability, creativity, impartiality, empathy, vision, awareness, entrepreneurship, diligence and versatility should be given to classroom teachers through in-service training. It is clear that the personal qualities of the teacher influence the attitudes of the child towards the school and the classes. Similarly, Erden (2005) argues that a teacher with a negative personality could cause the child to fall out of love with the course, complete departure from the school, or failure in the academic direction. In this context, it can be said that teachers' personal values and professional values complete each other. The similar findings are seen in previous studies. In the studies conducted by Çubukçu, Eker-Özenbaş, Çetintaş, Satı, and Yazlık-Şeker (2012), and Işıktaş (2015), creativity has taken its place as a value that teachers should have. In the studies conducted by Harris (2005), Lieberman (1992), Işıktaş (2015), Urbanski and Nickolaou (1997) vision as a value statement in terms of teaching profession, they were also expressed that 'teachers should make plan to achieve educational goals'. In another studies conducted by Karabacak (2016), Vidovic and Velkovski (2013), it was stated that the teachers should have professional goals for promoting both personal and professional development throughout the teaching career. The finding 'entrepreneurship as a personal value that teachers should have' is coherent with the finding of Karabacak (2016), and the finding about 'a fair attitude' is consistent with finding of Sezer (2016). In previous studies conducted by Gündüz and Aktepe (2017), Karabacak (2016), MEB (2008), Işıktaş (2015), Richardson and Watt (2006), Sezer (2016), Vidovic and Velkovski (2013), the results show that teachers must have personal values as openness to innovation, reliability, diligence, versatility. In the studies conducted by Aydın (2009), Çubukçu et al. (2012), Karabacak, Küçük, and Korkmaz (2015), Karabacak (2016) the findings show that empathy has a great influence on teacher and student relationships.

The professional values that should be provided to classroom teachers through in-service training were cooperation, professional love, leadership, role-modeling, self-renewal, self-sacrifice and solidarity. These results are similar to those of previous studies. In the studies conducted by Çubukçu et al. (2012), Karabacak, Küçük, and Korkmaz (2015), Karabacak (2016), Sezer (2016), Turhan, Demirli, and Nazik (2012), it was expressed that teachers must have professional values as professional love, role modeling, self-renewal and cooperation. It was seen that the most emphasized professional value in the literature was to be a role-model among the professional values that teachers should have. Actually, in the previous studies, it was emphasized that

teachers 'must be a model for educational stakeholders in developing national and universal values' (MEB, 2008); 'must be an ethic leader model in the classroom' (Lehr, 2003); 'must be an efficient model to teach values' (Çetingöz, 2015). In a study conducted by Vidovic and Velkovski (2013) it was expressed that teachers must have personal values such as collaboration, sharing developments in the field with colleagues and renewing oneself; in another study conducted by Boydak-Özan, Polat, and Şener (2014) the findings show that teachers must follow up on publications on innovations about their areas; in the researches of Gökmenoğlu, Beyazova, and Kılıçoğlu (2015), NCATE (2006), Uştu, Taş-Mentiş, and Sever (2016) the findings revealed that the teachers should have professional values in the form of sharing and solidarity. In the studies conducted by Çubukçu et al. (2012), Işıktaş (2015), Sezer (2016), it was mostly emphasized that teachers should have leadership skills.

The school principals stated that the professional skills that teachers should have through in-service training were communication skills, technology using skills, contextual knowledge, planning skills, material designing and using skills. The professional skill that all school principals have a common opinion on it and the most striking was 'communication skills'. These results are similar to those of previous studies. In the study of Sezer (2016) communication skills come first in the ideal teacher qualifications. Klis and Kossewska (1996) asserted that the communication skill is an important professional value that teachers need to possess in order to be able to understand the students' feelings and thoughts more closely and so they will be more sensitive towards them. For the professional success, teachers must be competent in their conceptual knowledge, they also should gain the perspective of the teaching profession, the basic subjects in the field and the relationships and connections between them (Eskicumalı, 2002). Erden (2005) states that the professional skills of the teacher are general culture, contextual knowledge, pedagogical knowledge and teaching skills. Contextual knowledge is related with the designing and application of learning and teaching process. Similarly, Eisenschmidt and Löfström (2008) suggest that teaching profession needs to be able with communication skills, democratic skills, ability to design and having comprehensive knowledge of program, the appropriate teaching process, and ability to prepare suitable learning environments for children with special education need. In addition, ability to design materials and use technology are taking part in the findings of (Gökmenoğlu, Beyazova, & Kılıçoğlu, 2015; Işıktaş, 2015; Karabacak et al., 2015; Karabacak, 2016; 2008; Özcan, 2011; Sezer, 2016; Uştu, Taş-Mentiş, & Sever, 2016; Tunca, 2012); planning skill in the finding of (Arslan & Özpınar, 2008; Sezer, 2016).

Moreover, in the studies conducted by Calderhead and Shorrock (1997), Montecinos and Nielsen (1997) it was revealed that the teachers must love the children, to improve the lives of children and to have responsibility for them. In some limited studies although the finding was found as 'if I had a new chance I would not choose teaching profession' (Çermik, Şahin, & Doğan, 2017), it is clear that the basic condition of being successful in the teaching profession is the profession love. Because the school teaching is a love profession needing 'to possess and to internalize professional values.' As a government policy, it is argued in the countries where the teaching profession is seen as a value and the teaching profession has a high status (Finland, Singapore, South Korea, UK, Shanghai, the Netherlands, Australia, USA) how to increase the value of

this profession. In these countries, it can be said that the teachers have professional values by completing a long-term and specialized professional education (Özcan, 2011).

On the basis of the results, it can be stated that the teacher candidates should be educated with universal values such as human dignity, justice, human love, democratic attitude, respect for differences, and tolerance. Teachers should be given personal values such as responsibility, openness to innovation, trustworthiness, creativity, fairness, empathy skills, vision, awareness, entrepreneurship, diligence and versatility through pre-service and in-service training. The professional skills such as cooperation, love of teaching profession, leadership, role-modeling, self-renewal, sacrifice and solidarity should be gained teachers through in-service training. Teachers should be equipped with communication skills, technology use skills, context knowledge, planning skills, material designing and using skills through pre-service and in-service training. In this context, further studies can be conducted in different patterns with different study groups.

References

Akyüz, Y. (2012). *Türkiye'de öğretmenlerin toplumsal değişmedeki etkileri* (*1839-1950*). (2. Baskı). Ankara: Pegem Akademi.

Altınkurt, Y., & Yılmaz, K. (2011). Öğretmen adaylarının öğretmenlerin mesleki etik dışı davranışlar ile ilgili görüşleri. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, 11*(22), 113-128.

Arslan, S., & Özpınar, İ. (2008). Öğretmen nitelikleri: İlköğretim programlarının beklentileri ve eğitim fakültelerinin kazandırdıkları. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi, 2*(1), 38-63.

Ataünal, A. (2003). *Niçin ve nasıl bir öğretmen.* Ankara: Mili Eğitim Vakfı Yayınları.

Aydın, İ. (2013). *Eğitim ve öğretimde etik*. Ankara: Pegem A Yayıncılık.

Aytaç, K. (1997). Atatürk'ün eğitim görüşü. İçinde, Genelkurmay Başkanlığı. *Atatürkçülük II*. (ss. 103-113). İstanbul: Milli Eğitim Basımevi.

Ayvacı, H. Ş., Bakırcı, H., & Yıldız, M. (2014). Fen bilimleri öğretmenlerinin hizmet içi eğitim uygulamalarına ilişkin görüşleri ve beklentileri. *Amasya Üniversitesi Eğitim Fakültesi Dergisi, 3* (2), 357-383.

Bayındır, N. (2015). Sınıf öğretmeni adaylarının alan ile ilgili kurslara/eğitimlere ilişkin beklenti durumlarının belirlenmesi. *Uluslararası Eğitim Bilimleri Dergisi, 2* (5), 395-404.

Bitan-Friedlander, N., Dreyfus, A., & Milgrom, Z. (2004). Types of 'teachers in training': The reactions of primary school science teachers when confronted with the task of implementing an innovation. *Teaching and Teacher Education, 20*(6), 607-619.

Boydak-Özan, M., Polat, H., & Şener, G. (2014). Sınıf öğretmenlerinin mesleki gelişim eğitimlerine ilişkin görüşlerinin belirlenmesi. *Uşak Üniversitesi Sosyal Bilimler Dergisi, 7*(4), 167-180.

Budak, Y., & Demirel, Ö. (2003). Öğretmenlerin hizmetiçi eğitim ihtiyacı. *Kuram ve Uygulamada Eğitim Yönetimi, 9*(1), 62-81.

Calderhead, J., & Shorrock, S. B. (1997). *Understanding teacher education*. London: Falmer Pres.

Creswell, J. W. (2015). *Nitel araştırma yöntemleri.* (Trans. Eds. M. Bütün & S. B. Demir) Ankara: Siyasal Kitabevi.

Çermik, H., Şahin, A., & Doğan, B. (2017). Sınıf öğretmen adaylarının meslek tercih algıları: Değişimin boylamsal çözümlemesi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 32*(3), 643-658. doi: 10.16986/HUJE.2016018402.

Çetingöz, D. (2015). Okul öncesi eğitimi öğretmen adaylarının değerler eğitimde öğretmenin rolüne ilişkin görüşleri. *Türkiye Sosyal Araştırmalar Dergisi, 19* (3), 33-52.

Çubukçu, Z., Eker-Özenbaş, D., Çetintaş, N., Satı, D., & Yazlık-Şeker, Ü. (2012). Yönetici, öğretmen, öğrenci ve veli gözünde öğretmenin sahip olması gereken değerler. *Pegem Eğitim ve Öğretim Dergisi*, *2*(1), 25-37.

Denzin, N. K., & Lincon, Y. S. (2005). *The Sage Handbook of Qualitative Research* (3rd Edition). Thousand Oaks, CA: Sage.

Downing, J. E., Ryndak, D. L., & Clark, D. (2000). Para-educators in inclusive classrooms: Their own perceptions. *Remedial and Special Education, 21*(3), 171-181. DOI: 10.1177/074193250002100308

EARGED (2008). *Sınıf öğretmenlerinin hizmetiçi eğitim ihtiyacının belirlenmesi.* Ankara: Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı.

Eisenschmidt, E., & Löfström, E. (2008). The significance of the European Commission's policy paper 'improving the quality of teacher education: Perspectives of Estonian teachers, teacher educators and policy-makers. In B. Hudson and P. Zgaga (Eds.). *Teacher Education Policy in Europe: A voice of higher education institutions* (pp. 63-84). University of Ljubljana.

Erden, M. (2005). *Öğretmenlik mesleğine giriş* (2. Baskı). İstanbul: Epsilon Yayıncılık.

Ergün, M., & Özdaş, A. (1999). Okul gözlemi ve uygulama çalışmalarının öğretmen adayları üzerindeki etkisi. *Afyon Kocatepe Üniversitesi Sosyal Bilimler Dergisi*, *1*(3), 115-119.

Eskicumalı, A. (2002). Eğitim, öğretim ve öğretmenlik mesleği. İçinde Y. Özden (Ed.). *Öğretmenlik mesleğine giriş.* (pp. 1-31). Ankara: Pegem A Yayıncılık.

Gökmenoğlu, T. (2013). İlköğretim öğretmenlerinin hizmetiçi eğitim gereksinimlerini belirlemeye yönelik bir ölçek geliştirme çalışması. *Öğretmen Eğitimi ve Eğitimcileri Dergisi, 2*(1), 31-52.

Gökmenoğlu, T., Beyazova, G., & Kılıçoğlu, A. (2015). Mesleki gelişim: Öğrenen olarak öğretmen eğitimcileri. *İlköğretim Online, 14*(2), 574-592. Retrieved from http://ilkogretim-online.org.tr

Gültekin, M., & Çubukçu, Z. (2008). İlköğretim öğretmenlerinin hizmetiçi eğitime ilişkin görüşleri. *Sosyal Bilimler Dergisi, 19*(1), 185-201.

Gündüz, M., & Aktepe, V. (2017). Sınıf öğretmenlerinin değer öğretimine yönelik zihin haritaları. *Bartın Üniversitesi Eğitim Fakültesi Dergisi*, *6*(2), 427-446. doi: 10.14686/buefad.279688

Harris, A. (2005). Teacher leadership: More than just a feel-good factor? *Leadership and Policy in Schools*, *4*(3), 201-219. DOI: 10.1080/15700760500244777

Işıktaş, S. (2015). Öğretmen adaylarının iyi öğretmen olma ile ilgili görüşleri. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 30*(4), 119-131.

Karabacak, N. (2016). *Sınıf öğretmenlerinin mesleki değerleri üzerine nitel bir çalışma* (Unpublished PhD Thesis). Necmettin Erbakan Üniversitesi, Eğitim Bilimleri Enstitüsü, Konya, Turkey.

Karabacak, N., Küçük, M., & Korkmaz, İ. (2015). Primary school teachers' professional values from the perspective of teaching expert. *Turkish Journal of Teacher Education, 4*(2) 66-100.

Karasu, N., Aykut, Ç., & Yılmaz, B. (2014). Zihin engelliler öğretmenlerinin hizmet içi eğitim ihtiyaçlarının belirlenmesi. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi, 15*(1), 41-53.

Kıranlı, S., & Yıldırım, Y. (2014). Okul yöneticileri ile öğretmenlerin hizmet içi eğitim etkinliklerine ilişkin görüşlerinin karşılaştırılması. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi, 14*(23), 219-251.

Klis, M., & Kossewska, J. (1996). *Empathy in the structure of personality of special educators*. ERIC Document Reproduction Service No. ED *405*(323), 1-12.

Lehr, J. B. (2003). Using learner-centered education to prepare teachers for ethical leadership. *Education*. *124*(1), 1-50.

Lieberman, A. (1992). *Teacher leadership: What are we learning*? In C. Livingston (Ed.). *Teachers as leaders: Evolving roles.* NEA School Restructuring Series. Washington DC: National Education Association. Retrieved from https://eric.ed.gov/?id=ED347631

Merriam, S. B. (2001). *Qualitative research and case study applications in education*. San Francisco: Jossey-Bass Publishers.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis*. Thousand Oaks, CA: Sage.

Milli Eğitim Bakanlığı, [MEB]. (2008). *Öğretmen yeterlikleri*: *Öğretmenlik mesleği genel ve özel alan yeterlikleri*. Ankara: Devlet Kitapları Müdürlüğü.

Montecinos, C., & Nielsen, L. (1997). Gender and cohort differences in university students' decisions to become elementary teacher education majors. *Journal of Teacher Education, 49*(1), 47-54.

National Education Association [NEA], (1975). *Code of ethics*. Retrieved from http://www.nea.org/home/30442.htm

National Council for Accreditation of Teacher Education [NCATE], (2006). *Council fort the accredition of educator preparation*. Retrieved from http://www.ncate.org

Neuman, L. V. (2013). *Toplumsal araştırma yöntemleri. Nitel ve nicel yaklaşımlar.* (2 Cilt). (Trans. S. Özge). İstanbul: Yayınodası Yayıncılık.

Özcan, M. (2011). *Bilgi çağında öğretmen eğitimi, nitelikleri ve gücü: Bir reform önerisi*. Ankara: Türk Eğitim Derneği, Yayın No: 11687.

Özcan, A., & Polat, S. (2016). Öğretim elemanlarının öğrencilerde görmek istediği değerler. *International Online Journal of Educational Sciences*, *5* (1), 138-149.

Richardson, P. W., & Watt, H. M. G. (2006). Who chooses teaching and why? Profiling characteristics and motivations across three Australian universities. *Asia-Pacific Journal of Teacher Education, 34*(1), 27-56. DOI: 10.1080/13598660500480290

Parmaksız, R. Ş., & Kısakürek, M. A. (2013). Türkiye ve bazı AB ülkelerinde öğretmenlere yönelik hizmetiçi eğitim programlarının temel öğeler ve kalite kontrolü/güvencesi açısından karşılaştırılması. *Karaelmas Journal of Educational Sciences, 1* (1), 112-129.

Paşa, B. (2002). *İlkokul sınıf öğretmenlerinin mesleki yeterliklerinin ve hizmet içi eğitim ihtiyaçlarının belirlenmesi* (Unpublished masters' thesis). Ankara Üniversitesi, Eğitim Bilimleri Enstitüsü, Ankara.

Pelit, E., & Güçer, E. (2006). Öğretmen adaylarının öğretmenlik mesleğiyle ilgili etik olmayan davranışlara ve öğretmenleri etik dışı davranışa yönelten faktörlere ilişkin algılamaları. *Ticaret ve Turizm Eğitim Fakültesi Dergisi*, *2*, 95-119.

Pepeler, E., Murat, A., & Akmençe, E. (2016). İlkokullarda hizmet içi eğitim seminerlerinin öğretmenlere yararlılığı (Elazığ ili örneği). *Eğitim ve Öğretim Araştırmaları Dergisi, 5*(2), 168-186.

Selvitopu, A., Bora, V., & Taş, A. (2015). Ortaöğretim öğrencilerine kazandırılması gereken değerlere ilişkin velilerin okuldan beklentileri. *Kastamonu Eğitim Dergisi*, *23*(3), 979-994.

Serin, M. K., & Korkmaz, İ. (2014). Sınıf öğretmenlerinin hizmet içi eğitim ihtiyaçlarının analizi. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *15*(1), 155-169.

Sezer, Ş. (2016). Okul yöneticilerinin ideal öğretmen niteliklerine ilişkin bilişsel kurguları: Repertory grid tekniğine dayalı fenomenolojik bir çözümleme. *Eğitim ve Bilim, 41*(186), 37-51.

Şahin, Ü. (2013). *Sınıf öğretmenlerinin hizmet içi eğitim ihtiyaçlarının belirlenmesi ve bir model önerisi.* (Unpublished PhD Thesis). Adnan Menderes Üniversitesi, Sosyal Bilimler Enstitüsü, Aydın, Türkiye.

Tunca, N. (2012). *İlköğretim öğretmenleri için mesleki değerler ölçeğinin geliştirilmesi ve ilköğretim öğretmenlerinin mesleki değerlerinin belirlenmesi* (Unpublished PhD Thesis). Anadolu Üniversitesi, Eğitim Bilimleri Enstitüsü, Eskişehir.

Turhan, M. (2010). *Kültür değişmeleri.* İstanbul: Çamlıca Yayınları.

Turhan, M., Demirli, C., & Nazik, G. (2012). Sınıf öğretmenlerinin mesleğe adanmışlık düzeyine etki eden faktörler: Elazığ örneği. *İstanbul Ticaret Üniversitesi Sosyal Bilimler Dergisi*, *11*(21), 179-192.

Uçar, A., Başar, M. A., & Hamarat, S. (2007). Çanakkale ilinde görev yapan sınıf öğretmenlerinin hizmetiçi eğitim ihtiyaçlarının belirlenmesine yönelik istatistiksel bir yaklaşım. *Çanakkale Araştırmaları Türk Yıllığı, 5* (5), 103-127.

Urbanski, A., & Nickolaou, M. B. (1997). Reflections on teachers as leaders. *Educational Policy*, *11*(2), 243-254.

Uştu, H., Taş-Mentiş, A., & Sever, B. (2016). Öğretmenlerin mesleki gelişime yönelik algılarına ilişkin nitel bir araştırma. *Elektronik Mesleki Gelişim ve Araştırma Dergisi*, *1*, 15-23. Retrieved from www.ejoir.org

Uşun, S., & Cömert, D. (2003). Okul öncesi öğretmenlerinin hizmet içi eğitim gereksinimlerinin belirlenmesi. *G.Ü. Gazi Eğitim Fakültesi Dergisi, 23*(2) 125-138.

Vidovic, V. V., & Velkovski, Z. (Eds.). (2013). *Teaching professional for 21st century: Advancing teacher professionalism for inclusive, quality and relevant education*-ATEPIE. Belgrade: Centre for Education Policy Svetozara Markovica.

Yeşiltaş-Doktaş, P., & Mentiş-Taş, A. (2016). Okul müdürlerinin değer ve değer kazanımına ilişkin görüşleri. *Hitit Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *9*(2), 1125-1146. doi: http://dx.doi.org/10.17218/hititsosbil.280834

Yılmaz, K., & Altınkurt, Y. (2009). Öğretmen adaylarının mesleki etik dışı davranışlar ile ilgili görüşleri. *İş Ahlakı Dergisi*, *2*(4), 71-88.

Yin, R. K. (2009). *Case study research: Desing and methods* (4th Edition). Thousand Oaks, CA: Sage Publications.

Journal of Theoretical Educational Science, 12(4), 1239-1256, October 2019
Kuramsal Eğitimbilim Dergisi, 12(4), 1239-1256, Ekim 2019
[Online]: https://dergipark.org.tr/akukeg
DOI number: http://dx.doi.org/10.30831/akukeg.467435

Examination of Critical Thinking Standards and Academic Self-Efficacy of Teacher Candidates as a Predictor of Metacognitive Thinking Skills through Structural Equation Modelling

Üstbilişsel Düşünme Becerilerinin Eleştirel Düşünme Becerileri ve Akademik Öz-Yeterlik ile İlişkisinin Yapısal Eşitlik Modellemesi ile İncelenmesi

Fatma Gizem KARAOĞLAN-YILMAZ [*] **Ramazan YILMAZ** [**]
Ahmet Berk ÜSTÜN[***] **Hafize KESER**[****]

Received: 04 October 2018 **Research Article** **Accepted:** 01 July 2019

ABSTRACT: The aim of this research is to examine the structural relationships between metacognitive thinking skills, critical thinking standards and academic self-efficacy of teacher candidates. The research was carried out according to the relational survey method and structural equation modelling was done in the analysis of the data. The data of the study were obtained from 244 teacher candidates. Personal information form, Critical Thinking Standards Scale, Metacognitive Thinking Scale and Academic Self-Efficacy Scale were used as data collection tools in the study. The findings of the research show that the teacher candidates have a positive moderate relationship between critical thinking standards and metacognitive thinking skills. There appears to be a positive low level of relationship between critical thinking standards and academic self-efficacy. There appears to be a positive moderate relationship between metacognitive thinking skills and academic self-efficacy. Various suggestions have been made to investigators and researchers in the findings obtained from the research.

Keywords: teacher candidates, critical thinking, metacognitive thinking, academic self-efficacy.

ÖZ: Bu araştırmanın amacı; öğretmen adaylarının üstbilişsel düşünme becerileri ile eleştirel düşünme becerileri ve akademik öz-yeterlikleri arasındaki yapısal ilişkileri incelemektir. Araştırma ilişkisel tarama yöntemine göre yürütülmüş olup, verilerin analizinde yapısal eşitlik modellemesi yapılmıştır. Araştırmanın verileri 244 öğretmen adayından elde edilmiştir. Araştırmada veri toplama aracı olarak; kişisel bilgi formu, Eleştirel Düşünme Standartları Ölçeği, Üstbilişsel Düşünme Ölçeği ve Akademik Öz-Yeterlik Ölçeği kullanılmıştır. Araştırma bulguları, öğretmen adaylarının eleştirel düşünme becerileri ile üstbilişsel düşünme becerileri arasında pozitif yönlü orta düzeyde, eleştirel düşünme becerileri ile akademik öz-yeterlikleri arasında pozitif yönlü düşük düzeyde, üstbilişsel düşünme becerileri ile akademik öz-yeterlikleri arasında pozitif yönlü orta düzeyde bir ilişkinin olduğunu göstermektedir. Araştırmadan elde edilen bulgular ışığında uygulayıcılara ve araştırmacılara yönelik çeşitli önerilerde bulunulmuştur.

Anahtar kelimeler: öğretmen adayları, eleştirel düşünme, üstbilişsel düşünme, akademik öz-yeterlik.

[*] *Corresponding Author*: Assoc. Prof. Dr., Bartın University, Bartin, Turkey, gkaraoglanyilmaz@gmail.com, https://orcid.org/0000-0003-4963-8083
[**] Assoc. Prof. Dr., Bartın University, Bartin, Turkey, ramazanyilmaz067@gmail.com, https://orcid.org/0000-0002-2041-1750
[***] Dr., Bartın University, Bartin, Turkey, ustun.ahmet.berk@gmail.com, https://orcid.org/0000-0002-1640-4291
[****] Prof. Dr., Ankara University, Ankara, Turkey, keser@ankara.edu.tr, https://orcid.org/0000-0001-5153-5492

Citation Information
Karaoğlan-Yılmaz, F. G., Yılmaz, R., Üstün, A. B, & Keser, H. (2019). Examination of critical thinking standards and academic self-efficacy of teacher candidates as a predictor of metacognitive thinking skills through structural equation modelling. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 12*(4), 1239-1256.

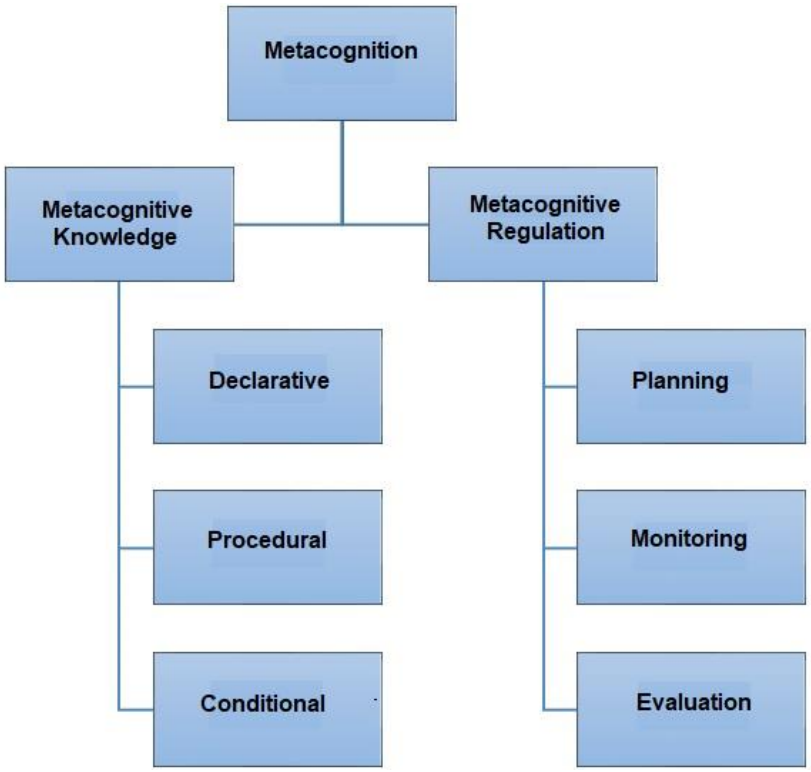
ISSN: 1308-1659

Introduction

In recent years, it has been seen that concepts such as learning to learn, effective learning, collaboration, and self-learning with technology come to the fore in the educational literature. In this sense, the concept of metacognition is an element that supports a student in gaining the student's self-learning ability (Akpunar, 2011). The main reason why the concept of metacognition comes to the forefront in the learning-teaching process is the assumption that metacognition promotes learner autonomy (Yılmaz, 2014).

In the literature, the concept of metacognition initially introduced by Flavell (1979) who defines metacognition as an individual's awareness of his/her own learning process. According to the definition, it is a result of metacognitive awareness that the individual is able to know best how to learn, develop and use effective strategies for learning, make self-evaluation about what and how much s/he learns as a result of the learning process. Brown (1987) discusses metacognition under the two dimensions as "Knowledge of Cognition" and "Regulation of Cognition" (see Figure 1). Cognitive knowledge can be classified into three central components which are declarative knowledge, procedural knowledge and conditional knowledge. This knowledge aids students to organize learning resources and to effectively utilize learning strategies.

Figure 1. Brown's (1987) Model of Metacognition



Declarative Knowledge: The student knows how to learn about his/her own learning. For instance, it is declarative knowledge that a student knows that s/he can't learn in the best way just by listening to the teacher. Successful students have a high

level of declarative knowledge and use this knowledge to a great degree in their learning processes.

Procedural Knowledge: The student knows what strategies should be employed in order to make a job or task in the best way. An example of procedure knowledge is that a student who knows that s/he can't learn in the best way just by listening to the teacher employs a variety of strategies such as taking notes while listening to the teacher, repeating things s/he was taught, taking advantage of additional resources in order to be able to make an effective learning. These strategies that students can benefit from in the learning process will help students to carry out meaningful learning.

Conditional Knowledge: Students know why and when to use learning strategies. If the student is not aware that a strategy s/he is applying is not useful in the learning process, s/he will continue to use it. For instance, it is a conditional knowledge that a student knows that s/he needs to highlight significant points to be able to learn effectively. This student sees her/his classmate who utilizes the summarizing strategy to comprehend a topic and uses this strategy. S/he realizes that this strategy is more effective than the strategy s/he previously used. This awareness that the student has developed demonstrates that the student has her/his advanced conditional knowledge.

Regulation of cognition is in the second category of the metacognitive model proposed by Brown (1987). It includes activities associated with the regulation of cognition, control and management of learning. These activities are planning, monitoring and evaluation.

Planning: It is the process of choosing appropriate strategies and preparing cognitive resources before learning. For instance, the student plans to read an article. Spending enough time to read and checking prior knowledge by looking at the important points in the article are given as examples of the process of planning for the student.

Monitoring: In a sense, monitoring enables the student to develop awareness associated with his/her performance in the learning process. An example of monitoring performance in the learning process can be given that a group of students read an article and ask questions each other such as "what is the main topic of the article?" in relation to measuring what they understand. The student performs the control and management of the learning process through monitoring.

Evaluation: It is the process of determining the effectiveness of the strategy used by the student to achieve the goal. An example of the evaluation process can be given that the student utilizing the summarizing strategy realizes that this strategy is not very effective and then decides to apply a new strategy. When the student encounters a problem situation, s/he can make assessments about the solution process of the problem by using above-stated metacognitive strategies.

According to Brown (1987), the significant point in the metacognitive process is the regulation of cognition. A set of strategies and techniques are employed in the regulation of cognition. One of them is to get the student to ask himself/herself questions about his/her own learning processes. According to Blakey and Spence (1990), it is required that the student asks himself/herself questions directed towards planning the learning process at the beginning of the learning process, monitoring the learning process while continuing the learning process, and evaluating the learning

process at the end of the learning process and answers these questions in order to regulate his/her own cognition in this strategy.

The student might ask himself/herself the following questions related to the planning, monitoring and evaluating of his/her own learning process through this period (Karaoğlan Yılmaz, Olpak, & Yılmaz, 2018; Kujawa & Huske, 1995; Yılmaz, 2014; Yılmaz & Keser, 2017);

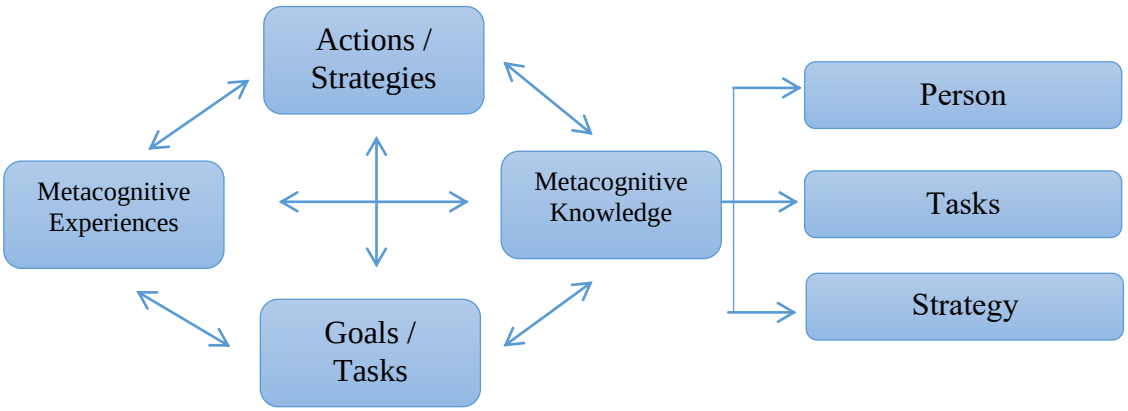
- In the planning process: "What information sources can help me in solving the present problem?", "What should I do first in the solution process?", "Where should I begin?", "Which strategy should I utilize?" etc.
- In the monitoring process: "Am I on the right track?", "Does the strategy I use work?", "What else can I do differently?" etc.
- In the evaluating process: "Did I do everything correctly?", "Is there anything I learn inadequately or wrongly?", "What did I learn from the task I did?" etc.

Researchers state that providing opportunities that enable the student to make planning, monitoring and evaluation practices that help him/her regulate his/her own cognitive processes will increase his/her metacognitive awareness and accordingly, metacognitive awareness will allow control and self-regulation on his/her thinking, learning processes and outcomes (Hartman, 1998; Karaoğlan Yılmaz, 2016; Yılmaz, 2014; Yurdakul, 2004).

According to Kuiper (2002), teaching the use of metacognitive strategies such as planning, monitoring and evaluation supports life-long reflective thinking, helps problem-solving, brings responsibility and develops self-confidence to make fast decisions. Metacognitive strategies for planning, monitoring and evaluation increase the level of the student's metacognitive awareness in respect to knowing cognitive resources and how to effectively and efficiently utilize all these resources in the best way. Successful learning can be achieved with the improvement of the level of metacognitive awareness (Livingston, 1997).

Flavell (1979) classifies metacognition into four components; metacognitive knowledge, metacognitive experiences, goals/tasks and actions/strategies. These four components are in constant interaction during the process of cognition control as seen in Figure 2.

Figure 2. Flavell's (1979) Model of Metacognition



Metacognitive knowledge, the first component in the metacognitive model of Flavell (1979), is related to the student's knowledge of his own cognitive processes. Flavell (1979) also categorizes metacognitive knowledge into three major variables including person, task, and strategy.

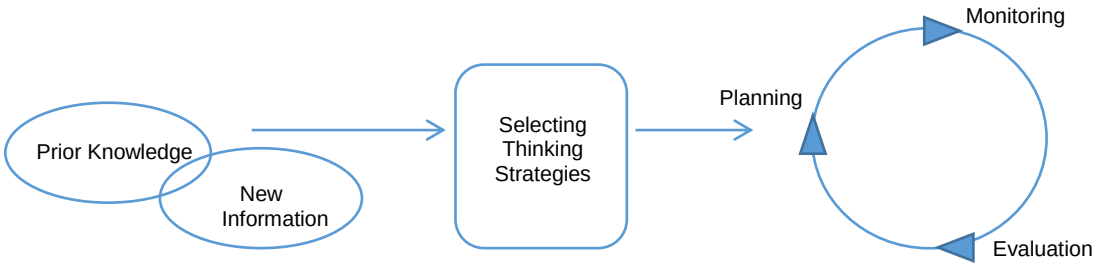
- *The person variables:* It is an individual's beliefs related to himself/herself and knowledge about himself/herself as a student. An example would be a student's self-belief that "I can use the word processor program well" (Yılmaz, 2014). The student thinks that these beliefs related to himself/herself will help him in the learning process. Flavell (1979) states that there are further three subcategories under this category: intraindividual, interindividual and cognitive generalizations.
    - *Intraindividual generalizations:* It is a person's beliefs towards himself/herself and knowledge about himself/herself.
    - *Interindividual generalizations:* It is a person's beliefs towards others and knowledge about others.
    - *Cognitive generalizations:* It is a person's generalizations that s/he determines towards all people, events and situations.
- *The task variables:* It is a knowledge that the individual has about the necessities of a task (job).
- *The strategy variables:* It is an individual's knowledge about strategies that s/he can apply when performing a task or solving a problem.

The metacognitive experience is another component in the metacognitive model. Metacognitive experiences are experiences that accompany a cognitive experience and are the feelings belonging to that experience. For example, it is a metacognitive experience that a student feels confused after encountering a new mathematical formula. Metacognitive experiences can take place frequently under similar circumstances. These experiences will also influence the interest of students and their similar learning in the future. Besides, another component is the goals or tasks in the metacognitive model. This component requires defining the goals or outcomes of a cognitive action in the model. An example would be that understanding of the workings of the internet is determined as the goal. The student's metacognitive knowledge and previous metacognitive experiences will be influential in completing the task successfully. The last component is the actions or strategies in the metacognitive model. Strategies are tactics and methods used to achieve the goal. Strategies require the planning, monitoring and regulation of cognition. For instance, a strategy can help the student understand how a mathematical formula works and how it should be used.

Blakey and Spence (1990) state that metacognition is a three-phase process. The phases of this process include;

a) Connecting new information to prior knowledge.
b) Selecting thinking strategies and
c) Carrying out the planning, monitoring, and evaluation during the thinking process

Figure 3. Metacognitive Processes (Blakey and Spence, 1990)



The student asks various questions about the planning, monitoring and evaluating phases and strives to manage his/her own cognition and learning process according to the answers given to these questions through the metacognitive process in Figure 3.

It can be pointed out that metacognition necessitates action to improve the situation by unveiling the current situation of the individual when looking into the structures described above about the concept of metacognition. In this sense, it can be stated that metacognitive thinking is based on a critical approach to the processes of the planning, monitoring and evaluation of the current situation of the individual and it is important for the individuals to have a developed academic self-efficacy in structuring these processes appropriately. However, when the literature was reviewed, any study investigating the structural relations between metacognitive thinking, critical thinking and academic self-efficacy was not found. Therefore, the aim of this study is to examine the structural relationships between metacognitive thinking skills and critical thinking standards and academic self-efficacy of teacher candidates. In the context of teacher candidates, this research that studies structural relationships between metacognitive thinking skills, critical thinking skills, and academic self-efficacy by handling them has a unique value. It is thought that the results of the study will contribute to the theoretical discussions associated with what can be done to improve the metacognitive thinking skills of teacher candidates.

Theoretical Framework and Hypotheses

The relationship between critical thinking skills and metacognitive thinking skills. Dewey defines critical thinking as supporting an idea and knowledge by considering an active, persistent and careful manner in the light of theoretical foundations and then making inferences (Dewey, 1909; as cited in Fisher, 2001). It is seen that Dewey defines critical thinking as an active process. Since, in the process of critical thinking, the individual is expected to have processes such as producing ideas on his/her own, asking himself/herself questions, and finding the relevant information on his/her own, as opposed to getting information or ideas from other people in a passive manner. Chance (1986) defines critical thinking as “the ability to analyze facts, generate and organize ideas, defend opinions, to make comparisons, draw conclusions, evaluate arguments and solve problems” (as cited in Huitt, 1998). It is seen that these skills indicated in the definition are related to the planning, monitoring and evaluation phases of the process of metacognitive thinking. Since, an individual is expected to reveal

his/her strengths and weaknesses by critically approaching his/her current situation, to plan towards overcoming deficiencies in his/her weaknesses by taking advantage of his/her strengths and to develop strategies for this in the planning phase of metacognitive thinking. However, the individual who cannot critically handle the planning phase of metacognitive thinking is not able to develop an effective strategy due to not being confidently aware of his/her strengths and weaknesses. In the monitoring and evaluation phases of the process of metacognitive thinking, the individual needs to critically approach the process in order to determine whether the strategies s/he developed work or not in the process and develop new strategies in place of the strategies that s/he can't take advantage. In this sense, it can be stated that critical thinking plays an important role in all phases of the process of metacognitive thinking. Therefore, it can be asserted that the development of individuals' critical thinking skills contributes to the development of their metacognitive thinking skills. However, it is seen that there is a need for research results that investigate the relationship between these two structures in terms of teacher candidates when the literature is examined. Thus, the first hypothesis of the study is as follows:

H1: *Critical thinking skills of teacher candidates are a significant predictor of metacognitive thinking skills.*

The relationship between academic self-efficacy and metacognitive thinking skills. Individuals' beliefs whether or not they can successfully achieve an academic task or educational and instructional goals at school can be referred to as academic self-efficacy (Bandura, 1997; Pajares, 2008). In other words, academic self-efficacy is addressed as the concept of self-efficacy in the context of school and academic tasks. The academic tasks that the student is expected to achieve throughout the education period, the perception of whether or not s/he can successfully perform are elucidated by the concept of academic self-efficacy (Bong & Skaalvik, 2003; Zimmerman, 2000). Students who have the perception of high academic self-efficacy aim to be successful, have positive expectations for achievement, enjoy taking risks, have the commitment to achieve academic tasks, don't give up when encountering difficulties, have no difficulties for self-control, have high confidence and are aware of their potential (Anderson, 2004). The perception of high academic self-efficacy that students have has various benefits. One of them is thought to be related to the contribution to the development of students' metacognitive thinking skills. For instance, a systematic review study conducted by Honicke and Broadbent (2016) revealed a moderate positive relationship between academic self-efficacy and academic performance. The student who has high academic self-efficacy will be able to more effectively organize the planning, monitoring and evaluation processes of metacognitive thinking. In these processes, the student is able to set attainable goals by being aware of his/her potential and will be able to evaluate whether or not s/he achieves these goals. If s/he has not achieved his/her goals, s/he will inquire about the reasons for this failure and generate new strategies to attain these goals. Therefore, the state of having advanced academic self-efficacy contributes to the development of students' metacognitive thinking skills. However, a student whose academic self-efficacy is not developed is not expected to demonstrate these behaviors. In this sense, it can be stated that academic self-efficacy plays an important role in the process of metacognitive thinking. Therefore, it can be asserted that the development of individuals' academic self-efficacy contributes to the

development of their metacognitive thinking skills. However, it is seen that there is a need for research results that investigate the relationship between these two structures in terms of teacher candidates when the literature is examined. Thus, the second hypothesis of the study is as follows:

H2: *The academic self-efficacy of teacher candidates is a significant predictor of metacognitive thinking skills.*

Method

Research Design

This study is designed as a correlational study to determine teacher candidates' metacognitive thinking skills, critical thinking skills and the level of academic self-efficacy and to investigate the structural relationships among them. As is known, survey models are models that aim to describe an event or situation as it exists. The event or situation is described in its own circumstances and as is (Creswell, 2012).

Study Group

The participants of this study consisted of 244 pre-service teachers who study in various departments of the faculty of education at a public university and voluntarily participate in the study. They were 116 (47.54%) first-year undergraduate students, 128 (52.46%) fourth-year undergraduate students. The participants of the undergraduate students were enrolled in the five departments including the Elementary Education (*f*=44, 18%), Social Science Teaching (*f*=52, 21.3%), the Turkish Language Teaching (*f*=43, 17.6%), Science Teaching (*f*=48, 19.6%), Elementary Mathematics Teaching (*f*=57, 23.5%). When the gender distribution of the undergraduate students was analyzed, it is seen that 60.7% (*f*=148) of them are female and 39.3% (*f*=96) of them are male. Their ages ranged from 18 to 25 years and the average was 19.82.

Data Collection Tools

The data were collected in the study by using the personal information form, the Metacognitive Thinking Scale, the Critical Thinking Standards Scale and Academic Self-Efficacy Scale.

Metacognitive Thinking Scale. The Motivated Strategies for Learning Questionnaire (MSLQ) was developed by Pintrich, Smith, Garcia and McKeachie (1991) and adapted into Turkish by Büyüköztürk, Akgün, Özkahveci and Demirel (2004). The aim of the scale is to determine the students' motivational orientations and their use of learning strategies in general. This scale consists of two essential sub-sections which are the motivation section that has 6 factors and the learning strategies section that has 9 factors and each section can be independently scored in a modular manner (Pintrich, Smith, Garcia, & McKeachie, 1993). Therefore, a metacognitive thinking subscale consisting of 12 items was used in this study. The scale has a seven-point Likert-type rating. The reliability (Cronbach alpha) value of the scale for the participants of this study is .81.

Critical Thinking Standards Scale. In order to measure students' critical thinking skills, critical thinking standards scale developed by Aybek, Aslan, Dinçer and

Arısoy (2015) consists of 42 items and three sub-dimensions (1- Depth, width and competence, 2- Precision and accuracy, 3- Importance, relevance and clarity). The scale has a five-point rating scale. The reliability value (Cronbach alpha) of the scale is .71 for the participants of this study.

Academic Self-Efficacy Scale. The scale developed by Owen and Froman (1988) to determine students' academic self-efficacy was adapted to Turkish by Ekici (2012). It consists of three sub-dimensions (1- Social status dimension, 2- Cognitive applications dimension and 3- Technical skills dimension) and 33 items. It has a five-point Likert-type rating. The reliability value (Cronbach alpha) of the scale is .93 for the participants of this study.

Data Analysis

In order to determine whether the data meet the requirements of structural equation modeling in the study, the data were analyzed in terms of sample size, linearity, normality and multiple linearity. Therefore, it was ascertained that the data were appropriate for structural equation modeling. Skewness-kurtosis (between -1 and +1) and Kolmogorov-Smirnov test (p>.05) were used to determine whether or not the distribution was normal, and normal distribution was found (Hair, Black, Babin, Anderson, & Tatham, 2013). The suitability of the data was analyzed for factor analysis via Kaiser-Meyer-Olkin (KMO) and Bartlett Sphericity. The test results showed that KMO values were .95 for the critical thinking standards scale, .88 for metacognitive thinking scale and .89 for the academic self-efficacy scale. It was found that KMO values were greater than .60 and the results of Bartlett Sphericity were significant (p<.05) so the data were suitable for factor analysis. Initially, the results of multiple correlation analysis were evaluated in order to determine the relations among the structures in the hypotheses. Then, a principal component analysis was used to explore the structural relationships between the scales. In the evaluation of the suitability of structural modeling; NFI, NNFI, X^2/df, RMSEA, GFI, AGFI and CFI fit indices were examined.

Findings

Findings Related to Scores Obtained from Scales

The results of the descriptive statistics related to students' responses to the scales are exhibited in Table 1.

Table 1

Descriptive Statistics

Scales	Number of items	Lowest score	Highest score	$\bar{X}$	*sd*	$\bar{X}/k$
Critical Thinking Standards Scale	42	97.00	173.00	140.89	13.78	3.35
Metacognitive Thinking Scale	12	24.00	84.00	55.67	12.04	4.64
Academic Self-Efficacy Scale	33	47.00	165.00	112.04	22.38	3.40

According to Table 1, it is seen that the participants' average score obtained from critical thinking standards scale was 140.89 (3.35 out of 5), their average score obtained from the metacognitive thinking scale was 55.67 (4.64 out of 7) and their average score obtained from academic self-efficacy scale was 112.03 (3.40 out of 5).

Based on (5-1)/3 evaluation interval, when the arithmetic average is between "1.00 – 2.33", "2.34 – 3.67" and "3.68 – 5.00" score range, the evaluation criterion is determined to respectively indicate low, moderate and high level for critical thinking standards scale and academic self-efficacy scale in the interpretation of the findings after data analysis (Kabakçı Yurdakul, 2011). Similarly, based on (7-1)/3 evaluation interval, when the arithmetic average is between "1.00 – 3.00", "3.01 – 5.00" and "5.01 – 7.00" score range, the evaluation criterion is determined to respectively indicate low, moderate and high level for metacognitive thinking scale. In this sense, it can be stated that students' critical thinking standards, metacognitive thinking skills and academic self-efficacy are moderate level.

Findings Related to Relationships between Variables

The Pearson correlation values showing the relationships between the scores of critical thinking standards, metacognitive thinking and academic self-efficacy are exhibited in Table 2.

Table 2

Correlation between Scales

		Critical thinking standards	Metacognitive Thinking	Academic self-efficacy
Critical thinking standards	*r*	1		
	p			
Metacognitive Thinking	*r*	.345**	1	
	p	.000		
Academic self-efficacy	*r*	.144*	.550**	1
	p	.024	.000	

*Correlation is significant at the .05 level

**Correlation is significant at the .01 level

When Table 2 is examined, the correlation values between the scores of critical thinking standards scale and metacognitive thinking scale are ($r = .345$, $p < .01$), the correlation values between the scores of critical thinking standards scale and academic self-efficacy scale are ($r = .144$, $p < .05$) and the correlation values between the scores of metacognitive thinking scale and academic self-efficacy scale are ($r = .550$, $p < .01$). According to Büyüköztürk (2017), correlation values between from $r = .00$ to .30 indicate a small relationship, between from $r = .31$ to .70 indicate a moderate relationship and between from $r = .71$ to 1 indicate a strong relationship. Based on the findings, it can be pointed out that there is a positive moderate correlation between critical thinking standards scale and metacognitive thinking scale, a positive low correlation between critical thinking standards scale and academic self-efficacy scale

and a positive moderate correlation between metacognitive thinking scale and academic self-efficacy scale.

Results of Path Analyses

The fit indices of the model based on the results of the analysis are demonstrated in Table 3.

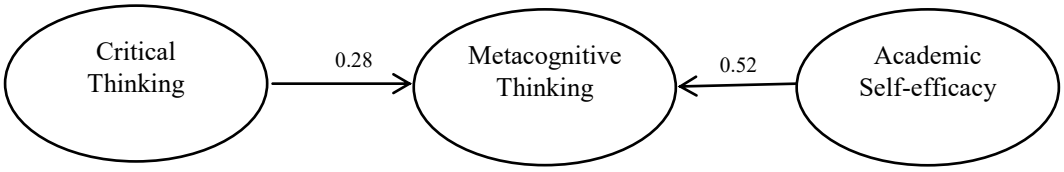
Table 3

Evaluation of Model Fit Indices

Fit indices	Criteria for acceptable fit	Model value (standard)	Resources
x^2 / df	$0 \leq x^2/df \leq 3$	2.75	Kline (2005), Sümer (2000)
RMSEA	$0 \leq RMSEA \leq .08$	.08	Hooper, Coughlan, and Mullen (2008)
NFI	$.90 \leq NFI \leq 1.00$	.97	Thompson (2004)
NNFI	$.90 \leq NNFI \leq 1.00$	.95	Tabachnick and Fidell (2007)
CFI	$.90 \leq CFI \leq 1.00$	.98	Tabachnick and Fidell (2007)
GFI	$.90 \leq GFI \leq 1.00$	.99	Tabachnick and Fidell (2007), Miles and Shevlin (2007)
AGFI	$.90 \leq AGFI \leq 1.00$	.96	Tabachnick and Fidell (2007)

When Table 3 is examined, it is ascertained that the fit indices are acceptable. The results from path analysis which was conducted to reveal the structural relationships between the scales are illustrated in Figure 4.

Figure 4. Hypothetical Model of Structural Relations between Scales



When the structural model in Figure 4 is examined, it is seen that the most significant variable on metacognitive thinking is academic self-efficacy and regression coefficient is β=.52. The regression coefficient of critical thinking on metacognitive thinking is β=0.28. The acceptance/rejection of hypotheses is given in Table 4.

Table 4

Acceptance / Rejection of Hypotheses for Proposed

Hypothesis	Structural Relationship	If Hypothesis Supported
H1	Critical thinking standards → Metacognitive thinking skills	Yes
H2	Academic self-efficacy → Metacognitive thinking skills	Yes

When Table 4 is examined, it is seen that all hypotheses are accepted. Therefore, teacher candidates' critical thinking skills are a significant predictor of their metacognitive thinking skills and similarly, their academic self-efficacy is a significant predictor of their metacognitive thinking skills.

Discussion and Conclusion

In this study, the role of critical thinking skills and academic self-efficacy as a predictor of metacognitive thinking skills of teacher candidates was investigated. In this sense, metacognitive thinking scale (Büyüköztürk et al., 2004), critical thinking standards scale (Aybek et al., 2015) and academic self-efficacy scale (Ekici, 2012) were used in the study and the relationships among the scales were scrutinized through structural equation modeling.

The findings demonstrated that there is a positive moderate correlation between metacognitive thinking and critical thinking standards scales in the study. Similarly, it was revealed that there is a positive moderate correlation between metacognitive thinking and academic self-efficacy scales. On the other hand, it is unveiled that there is a positive low correlation between the critical thinking standards and the academic self-efficacy scales. These findings indicated that the development of students' critical thinking skills and academic self-efficacy will contribute to the development of their metacognitive thinking skills. According to these results, it is possible to assert that critical self-efficacy standards and metacognitive thinking are statistically significant predictors of critical thinking standards.

When the literature was reviewed, it was found out that there are various research results investigating the relationships between metacognitive thinking skills and critical thinking skills within different samples and contexts. Arslan (2018) who probed the relationships between critical thinking and metacognition on 390 undergraduate students who were enrolled in a variety of programs at Sakarya University, in Turkey found that there is a significant positive correlation between students' critical thinking skills and metacognitive thinking skills in his study. Sadeghi, Hassani and Rahmatkhah (2014) conducted a study on female and male students between the age ranges of (15-23) years, and their results revealed that there is a positive significant relationship between metacognitive thinking skills and critical thinking skills for both male and female students. A study was conducted by Samsudin and Hardini (2019) who investigated the influence of metacognitive thinking skills on critical thinking by collecting data from 55 students who enrolled in a Korean Education Study Program at a state university in Indonesia and revealed that metacognitive skills have a significant influence on their critical thinking. Mall-Amiri and Ahmadi (2014) examined the relationship between EFL students' critical thinking skills and

metacognitive thinking skills in their research. It was concluded that there is a significant positive relationship between the two components as a result of their research. A study was conducted by Karasakaloğlu, Karacaloğlu and Özelçi (2012) who aimed to identify Turkish language teacher candidates' metacognitive reading strategies, critical thinking attitudes, and motivational cognitive and metacognitive competencies. They uncovered that there is a significant positive correlation between critical thinking attitude and metacognitive skills scale. Another study conducted by Semerci and Elaldi (2014) revealed that there is a positive significant relationship between metacognitive beliefs and critical thinking skills, but the relationship can be considered as lower than moderate level. Lukitasari, Hasan and Murtafiah (2019) explored the relationship between metacognitive abilities and critical thinking skills by sampling 76 students who study in the Department of Biology Education, Indonesia and unearthed that there is a strong positive relationship between the two structures. Based on these results, it can be concluded that the development of students' critical thinking skills contributes to the development of their metacognitive thinking skills.

When the literature was surveyed, it was ascertained that there are various research results exploring the relationships between metacognitive thinking skills and self-efficacy within different samples and contexts. Chen, Björkman, Zou and Engström (2019) conducted a study aimed to scrutinize the relationships between the self-regulated learning ability, metacognitive ability and general self-efficacy of 216 nursing students at a university in China and found positive relationships between the three structures as a result. A study conducted by Tunca and Alkın-Şahin (2014) revealed that there is a positive significant positive relationship between teacher candidates' academic self-efficacy beliefs and their metacognitive learning strategies. Another study conducted by Koç and Arslan (2017) unveiled that there is a positive significant positive relationship between secondary school students' metacognitive awareness of reading strategies and their academic self-efficacy. Coutinho and Neuman (2008) examined the relationship between achievement goal orientation, learning style, self-efficacy and metacognition by collecting data from 629 undergraduate students. They found out that there is a significant positive relationship between students' self-efficacy and their metacognitive thinking skills. This aligns with Moradkhani, Raygan and Moein (2017) who indicated there is a strong correlation between 102 Iranian EFL teachers' self-efficacy and their metacognitive reflection according to the result of their study. Based on these results, it can be concluded that the development of students' critical thinking skills contributes to the development of their metacognitive thinking skills.

In light of the findings obtained from the research, it would be beneficial to develop their critical thinking skills and academic self-efficacy in order that their metacognitive skills can be utilized. When it is taken into account that the development of critical thinking skills and academic self-efficacy is a lengthy process, it will be appropriate to create instructional programs to help students acquire these skills at an early age. This study has some limitations. Although the research was conducted on the adequate sample size, it included only teacher candidates as a sample group, so it is possible to investigate the generalizability of the results by conducting similar studies in different samples such as primary, secondary, high school students and adults. Besides, instead of conducting research on teacher candidates, doing research on students studying in different fields such as medical education and engineering can be repeated

in the future in order to compare model results. Similarly, the model results can be compared in future studies by taking into consideration the variables such as gender, age, and departments where teacher candidates study. In order to develop metacognitive thinking in the design of learning environments, practices that enhance academic self-efficacy can be implemented. The change of metacognitive skills between the groups in which academic self-efficacy support is provided and the groups in which this support is not given can be investigated. Similarly, the results of the model can be examined whether the metacognitive thinking skills differ between the groups of students who have high critical thinking skills and the groups of students who have low critical thinking skills.

References

Akpunar, B. (2011). Biliş ve üstbiliş (metabiliş) kavramlarının zihin felsefesi açısından analizi. *Electronic Turkish Studies*, *6*(4), 353-365.

Anderson, K. L. (2004). *Effects of participation in a guided reflective writing program on middle school students academic self-efficacy and self-regulated learning strategy use*. PhD Thesis, University of Colorado, Denver, USA.

Arslan, S. (2018). Investigating predictive role of critical thinking on metacognition with structural equation modeling. *MOJES: Malaysian Online Journal of Educational Sciences*, *3*(2), 1-10.

Aybek, B., Aslan, S., Dinçer, S., & Arısoy, B. C. (2015). Öğretmen adaylarına yönelik eleştirel düşünme standartları ölçeği: Geçerlik ve güvenirlik çalışması. *Kuram ve Uygulamada Eğitim Yönetimi Dergisi*, *21*(1), 25-50.

Bandura, A. (1997). *Self-efficacy*. The exercise of control. New York: Freeman & Co. Student Success.

Blakey, E., & Spence, S. (1990). *Developing metacognition*. ERIC Digest.

Bong, M., & Skaalvik, E. M. (2003). Academic self-concept and self-efficacy: How different are they really? *Educational Psychology Review*, *15*(1), 1-40.

Brown, A. L. (1987). Metacognition, executive control, self-regulation, and other more mysterious mechanisms. In F. E. Weinert, R. H. Kluwe (Eds.), *Metacognition, motivation, and understanding* (65-116). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Büyüköztürk, Ş. (2017). Sosyal bilimler için veri analizi el kitabı: İstatistik, araştırma deseni, SPSS uygulamaları ve yorum (24. baskı). *Ankara: Pegem Yayınları*.

Büyüköztürk, S., Akgün, Ö. E., Özkahveci, Ö., & Demirel, F. (2004). Güdülenme ve öğrenme stratejileri ölçeğinin Türkçe formunun geçerlik ve güvenirlik çalışması. *Kuram ve Uygulamada Eğitim Bilimleri*, *4*(2), 207-239.

Chen, J. H., Björkman, A., Zou, J. H., & Engström, M. (2019). Self–regulated learning ability, metacognitive ability, and general self-efficacy in a sample of nursing students: A cross-sectional and correlational study. *Nurse Education in Practice, 37*, 15-21.

Coutinho, S. A., & Neuman, G. (2008). A model of metacognition, achievement goal orientation, learning style and self-efficacy. *Learning Environments Research*, *11*(2), 131-151.

Creswell, J. (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. New Jersey: Pearson: Merrill Prentice Hall.

Ekici, G. (2012). Akademik öz-yeterlik ölçeği: Türkçeye uyarlama, geçerlik ve güvenirlik çalışması. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *43*,174-185.

Fisher, A. (2001). *Critical thinking–an introduction*. Cambridge: Cambridge University Press.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *American Psychologist*, *34*(10), 906-911.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2013). *Multivariate data analysis*. Pearson Education Limited.

Hartman, H. J. (1998). Metacognition in teaching and learning: An introduction. *Instructional Science, 26*(1), 1-3.

Honicke, T., & Broadbent, J. (2016). The influence of academic self-efficacy on academic performance: A systematic review. *Educational Research Review, 17*, 63-84.

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural equation modelling: guidelines for determining model fit. *The Electronic Journal of Business Research Methods, 6*(1), 53-60.

Huitt, W. (1998). Critical thinking: an overview. *Educational Psychology Interactive*. Valdosta, GA: Valdosta State University.

Kabakçı Yurdakul, I. (2011). Öğretmen adaylarının teknopedagojik eğitim yeterliklerinin bilgi ve iletişim teknolojilerini kullanımları açısından incelenmesi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 40*(1), 397-408.

Karaoğlan Yılmaz, F. G. (2016). The relationship between metacognitive awareness and online information searching strategies. *Pegem Journal of Education and Instruction, 6*(4), 447-468.

Karaoğlan Yılmaz, F. G., Olpak, Y. Z., & Yılmaz, R. (2018). The effect of the metacognitive support via pedagogical agent on self-regulation skills. *Journal of Educational Computing Research, 56*(2), 159-180.

Karasakaloğlu, N., Karacaloğlu, A. S., & Özelçi, S. Y. (2012). Türkçe öğretmeni adaylarının okuma stratejileri, eleştirel düşünme tutumları ve üst bilişsel yeterlilikleri. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi, 13*(1), 207-221.

Kline, R. B. (2005). *Principles and practice of structural equation modeling (2nd ed.)*. NY: Guilford Press.

Koç, C., & Arslan, A. (2017). Ortaokul öğrencilerinin akademik öz yeterlik algıları ve okuma stratejileri bilişüstü farkındalıkları. *Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi, 14*(1), 745-778.

Kuiper, R. (2002). Enhancing metacognition through the reflective use of self regulated learning strategies. *The Journal of Continuing Education in Nursing, 33*(2), 78-87.

Kujawa, S., & Huske, L. (1995). *Strategic teaching and reading project guidebook*. NCREL.

Livingston, J. A. (1997). *Metacognition: an overview*. 03 May 2019 Retrieved from http://files.eric.ed.gov/fulltext/ED474273.pdf

Lukitasari, M., Hasan, R., & Murtafiah, W. (2019). Using critical analysis to develop metacognitive ability and critical thinking skills in biology. *Jurnal Pendidikan Biologi Indonesia, 5*(1), 151-158.

Mall-Amiri, B., & Ahmadi, Z. (2014). The relationship between EFL learners' critical thinking, and metacognitive strategies. *International Journal of Language Learning and Applied Linguistics World, 5*(1), 488-505.

Miles, J., & Shevlin, M. (2007). A time and a place for incremental fit indices. *Personality and Individual Differences, 42*(5), 869–874.

Moradkhani, S., Raygan, A., & Moein, M. S. (2017). Iranian EFL teachers' reflective practices and self-efficacy: Exploring possible relationships. *System, 65*, 1-14.

Owen, S.V., & Froman, R.D. (1988). *Development of a college academic self-efficacy scale*. (Report No. TM 012 263). East Lansing, MI: National Center for Research on Teacher Learning. (ERIC Document Reproduction Service No. ED298158)

Pajares, F. (2008). Motivational role of self-efficacy beliefs in self-regulated learning. In D. H. Schunk & B. J. Zimmerman (Eds.), *motivation and self-regulated Learning: theory, research and applications*. New York: Routledge.

Pintrich, P.R., Smith, D.A.F., Garcia, T. & McKeachie, W.J. (1991). *A manual for the use of the motivated strategies for learning*. Michigan: School of Education Building, The University of Michigan. ERIC database number: ED338122.

Pintrich, P.R., Smith, D.A.F., Garcia, T. & McKeachie, W.J. (1993). Reliability and predictive validity of the motivated strategies for learning questionnaire (MSLQ). *Educational and Psychological Measurement, 53*(3), 801-814.

Sadeghi, B., Hassani, M. T., & Rahmatkhah, M. (2014). The relationship between EFL learners' metacognitive strategies, and their critical thinking. *Journal of Language Teaching & Research, 5*(5), 1167-1175.

Samsudin, D., & Hardini, T. (2019). The influence of learning styles and metacognitive skills on students' critical thinking in the context of student creativity program. *International Journal of Education, 11*(2), 117-124.

Semerci, Ç., & Elaldi, Ş. (2014). Eleştirel düşünme becerilerinin gelişiminde üstbilişsel inançların rolü. *Bartın Üniversitesi Eğitim Fakültesi Dergisi*, *3*(2), 317-333.

Sümer, N. (2000). Yapısal eşitlik modelleri. *Turkish Psychological Articles, 3*(6), 49-74.

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics (5th ed.)*. New York: Allyn and Bacon

Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications*. Washington: American Psychological Association.

Tunca, N., & Alkın-Şahin, S. (2014). Öğretmen adaylarının bilişötesi (üst biliş) öğrenme stratejileri ile akademik öz yeterlik inançları arasındaki ilişki. *Anadolu Journal of Educational Sciences International*, *4*(1), 47-56.

Yılmaz, R. (2014). *Çevrimiçi öğrenmede etkileşim ortamının ve üstbilişsel rehberliğin akademik başarı, üstbilişsel farkındalık ve işlemsel uzaklığa etkisi* (Yayımlanmamış Doktora Tezi). Ankara Üniversitesi, Eğitim Bilimleri Enstitüsü, Ankara.

Yılmaz, R., & Keser, H. (2017). The impact of interactive environment and metacognitive support on academic achievement and transactional distance in online learning. *Journal of Educational Computing Research, 55*(1), 95-122.

Yurdakul, B. (2004). *Yapılandırmacı öğrenme yaklaşımının öğrenenlerin problem çözme becerilerine, bilişötesi farkındalık ve derse yönelik tutum düzeylerine etkisi ile öğrenme sürecine katkıları* (Yayımlanmamış Doktora Tezi). Hacettepe Üniversitesi Sosyal Bilimler Enstitüsü, Ankara.

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology, 25*(1), 82-91.

Journal of Theoretical Educational Science, 12(4), 1257-1283, October 2019
Kuramsal Eğitimbilim Dergisi, 12(4), 1257-1283, Ekim 2019
[Online]: https://dergipark.org.tr/akukeg
DOI number: http://dx.doi.org/10.30831/akukeg.471086

Development of Children's Rights Education Curriculum for Prospective Preschool Teachers

Okul Öncesi Öğretmen Adayları İçin Çocuk Hakları Eğitimi Programının Geliştirilmesi

Ayşe ÖZTÜRK*

Received: 16 October 2018 **Research Article** **Accepted:** 17 April 2019

ABSTRACT: In this study, it was aimed to develop the Children's Rights Education Curriculum (CREC) for prospective preschool teachers (PPTs). In the study, 42 PPTs studying at the second-grade level were provided education with CREC for 28 weeks. Within the scope of the CREC, an education process consisting of three stages aimed at developing understanding, skills and attitude was organized for children's rights (CR) and children's rights education **(**CRE). In the first stage, studies were carried out to develop understanding and attitude for CR, the violation of CR and the UNCRC. In the second stage, studies were carried out for the development of the characteristics of CRE and CRE-based educational environment and the development of attitude towards CRE. Also, in this process, attitude development studies for CR were maintained. In the third stage, studies were carried out for the development of activity planning and material designing skill and the development of attitude. The study results showed that positive developments occurred in the understanding regarding the violation of CR, CR and UNCRC, the attitudes towards CR and CRE, and the event planning and material designing skills related to CRE of PPTs after the CREC. The study is important in terms of being a model application for the integration of CRE into pre-school teacher training programs and providing information in this context.

Keywords: children's rights education, curriculum development, prospective preschool teachers, teacher training.

ÖZ: Bu araştırmada, okul öncesi öğretmen adayları (OÖA'lar) için Çocuk Hakları Eğitimi Programı'nın (ÇHEP'in) geliştirilmesi amaçlanmıştır. Araştırmada, ikinci sınıf düzeyinde öğrenim görmekte olan 42 OÖA'ya ÇHEP ile 28 hafta eğitim verilmiştir. ÇHEP kapsamında, çocuk hakları (ÇH) ve çocuk hakları eğitimi (ÇHE) için anlayış, beceri ve tutum geliştirmeye yönelik üç aşamadan oluşan bir eğitim süreci organize edilmiştir. Birinci aşamada ÇH, ÇH ihlali ve BMÇHS ilişkin anlayış ve tutum gelişimi için çalışmalar yapılmıştır. İkinci aşamada, ÇHE ve ÇHE temelli eğitim ortamının özellikleri ile ÇHE'ye yönelik tutum gelişimi üzerine uygulamalar yapılmıştır. Ayrıca, bu süreçte ÇH için tutum gelişimi çalışmalarına devam edilmiştir. Üçüncü aşamada ise ÇHE'ye ilişkin etkinlik planlama ve materyal tasarlama becerisi ile tutum gelişimi için çalışmalar gerçekleştirilmiştir. Araştırma sonuçları, ÇHEP sonrasında OÖA'ların ÇH ihlaline, ÇH'ye ve BMÇHS'ye ilişkin anlayışlarında, ÇH'ye ve ÇHE'ye yönelik tutumlarında, ÇHE'ye ilişkin etkinlik planlama ve materyal tasarlama becerilerinde olumlu yönde gelişmeler meydana geldiğini göstermiştir. Araştırma, okul öncesi öğretmen yetiştirme programlarına ÇHE entegrasyonu için örnek bir uygulama olması ve bu bağlamda bilgi sağlaması açısından önem taşımaktadır.

Anahtar kelimeler: çocuk hakları eğitimi, program geliştirme, okul öncesi öğretmen adayları, öğretmen eğitimi.

**Corresponding Author*: Asst. Prof. Dr., Gaziantep University, Gaziantep, Turkey, ozturkayse2007@gmail.com, https://orcid.org/0000-0001-9279-1716

Citation Information
Öztürk, A. (2019). Development of children's rights education curriculum for prospective preschool teachers. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 12*(4), 1257-1283.

ISSN: 1308-1659

Introduction

Children's rights (CR) can be defined as a special part of human rights that aim to protect children from all kinds of damages and bring them to the living standards they deserve. All children in the world have these rights that aim to raise children safely and both psychologically and physically healthy. Various documents have been published within the historical process to give children the rights they have. The most important one of them has become the UN Convention on the Rights of the Child (UNCRC). UNCRC has been the most well-known and commonly supported international convention on human rights for children's rights (Ranson, 2012). This convention, which is a revolutionary document with its capacity to improve the lives of children, obliges contracting countries to respect, protect and meet all children's rights within the international context (Lansdown, Jimerson, & Shahroozi, 2014). In this context, contracting countries are obliged to ensure that the UNCRC is implemented and that adults and children learn its principles and provisions. In this consciousness and awareness raising process, it is necessary to internalize the UNCRC in school curricula, and it should be learnt by children in a widespread way (Hodgkin & Newel, 1998). To this end, a systematic education process must be implemented in order to introduce and disseminate the UNCRC starting from the first years of childhood (Flowers et al., 2009). In this case, it is necessary to start building the human rights culture in the pre-school period (Batur Musaoğlu & Haktanır, 2012). Therefore, preschools must be turned into places where children learn and implement their rights (Osler & Starkey, 1994). The United Nations Committee on the Rights of the Child also draws attention to the implementation of children's rights starting from the pre-school period, not exposing children to discrimination, and providing health, nutrition, social security, sufficient life standard, play, entertainment and participation rights (UN Committee on the Rights of the Child, General Comment No.7, 2005).

Teaching children's rights in the preschool period ensures that children develop a positive personality in addition to becoming citizens who are aware of their rights in the future (National Council for Social Studies (NCSS), 1998). The integration of CR into pre-school education policies is also an important factor for increasing justice for children. Therefore, CR play an important part in the development of preschool education policies (Smith, 2017). Accordingly, many countries require that their preschool education process is implemented within a framework that respects human values and freedoms, and children and educators exhibit behaviours and attitudes that reflect human rights (Quennerstedt, 2016). In this context, preschool education teachers and schools are responsible for creating an educational environment in which children have the right and children's rights are implemented (Brantefors & Quennerstedt, 2016). This requires that preschool teachers and PPTs who will teach in the future have knowledge and skills with regard to CR and CRE. Accordingly, it is observed that various studies have also been conducted in the context of preschool teachers, PPTs and children's rights in the relevant literature. Among these studies, Robson (2016) examined preschool teacher standards in England in terms of children's rights and suggested a proposal for the integration of the UNCRC. In his postgraduate thesis, Trägårdh (2009) examined the opinions of South African preschool teachers on children's rights and what did they do for children's rights. In their study, Neslitürk and Ersoy (2007) examined the practices developed by PPTs for

children's rights education. In their studies, Doğan, Torun, and Akgün (2014) aimed to determine prospective preschool teachers' opinions on children's rights. Faiz and Kamer (2017), investigated prospective preschool teachers' views related to children's rights in a part of their study. Tozduman Yaralı and Güngör Aytar (2017) examined the childrens' participation rights in preschool education practices according to the opinions of teacher and children by using case study. In their study Koran and Avcı (2017) aimed to analyse pre-school teachers' negative or positive applications for children's participation rights from the perceptions of prospective pre-school teachers. Te One (2008) investigated the perceptions of teachers, parents, and children of the early childhood rights in New Zealand. In their studies, Bilir Seyhan and Arslan Cansever (2017) examined prospective preschool teachers' perceptions of children's rights by the children's rights-themed board preparation study. Leblebici and Çeliköz (2017), Kaya (2011) and Değirmenci (2011) examined prospective preschool teachers' attitudes towards children's rights in a part of their study. In their study Kardeş, Banko, Eren, and Antakyalıoğlu (2017) aimed to investigate prospective preschool teachers' opinions regarding children's rights. Kozikoğlu (2018) investigated pre-school teachers' opinions about children's rights and children participation rights with mixed method. Coşkun (2015) examined PPTs' beliefs about children's right to participation while. In the first part of their study, Türkoğlu and Gültekin Akduman (2013) examined the curriculum of higher education institutions with preschool education programs in Turkey in the children's rights dimension. In the second part, they determined prospective preschool teachers' opinions on children's rights. Turnšek (2016) aimed to examine how pre-school teachers work on children's rights. In this context, the researcher focused on children's right to participation and physical punishment. Hudson (2012) examined preschool teachers' opinions and perceptions of children's right to participation. When these studies are generally evaluated, it is observed that it has been focused on the investigation of the awareness, beliefs, and practices with regard to CR and UNCRC, the evaluation of teacher's training standards in terms of CR, and the investigation of opinions, understanding, and practices in relation to children's right to participation. In this context, it can be said that the studies aimed at obtaining information about the current situation have been mainly carried out rather than the program development studies for knowledge and skill acquisition. Nevertheless, preschool teachers should acquire the necessary knowledge and skills in pre-service training so that they can recognize, protect and implement children's rights and provide guidance to families (Türkoğlu & Gültekin Akduman, 2013). Indeed, Jerome, Emerson, Lundy, and Orr (2015) indicate that teacher training constitutes the most important field of action in the implementation of children's rights education. Therefore, there is a need for program development studies aimed at gaining knowledge, skills, and attitudes for CRE in the education process of PPTs.

On the other hand, it is necessary for teacher policies to be consistent with other policies such as CR and human rights (United Nations Children's Fund (UNICEF), 2014). It is observed that various countries start to make certain arrangements for CR and CRE in teacher's training in parallel to this situation. For example, in Scotland, the commitment to the UNCRC is stated as a basic requirement for new teachers (General Teaching Council for Scotland (GTCS), 2012). In Australia, the ability of PPTs to make arrangements for CR is emphasised among the standards for raising PPTs (Proficient Teacher Evidence Guide Early Childhood Teachers, 2017). In Canada, it is stated that

teachers are trained on CR, but this does not apply to the whole country (Jerome et al., 2015). In Turkey, it was directly indicated to make arrangements for CRE in the pre-school curriculum. Accordingly, it was aimed to develop the knowledge, skills and attitudes in relation to children's protecting both their and other people's rights, talking about their rights, and what they can do when are treated in an unfair manner. In this context, PPTs are expected to raise awareness among children with various activities based on the UNCRC (Ministry of National Education, 2013). This draws attention to the fact that PPTs should have the necessary knowledge, skills and attitudes for an effective CRE in the process of preschool education. Nevertheless, no lesson is defined for children's rights education in the pre-service education processes of PPTs by the Council of Higher Education (CHE) in Turkey. This shows the need to conduct studies for the integration of CRE into the education processes of PPTs. Nevertheless, no study on the development of a children's rights education curriculum for PPTs in Turkey was found, limited to resources that can be accessed by reviewing the relevant literature. The studies conducted on PPTs generally focused on the investigation of the opinions and attitudes of PPTs on CR and CRE (Değirmenci, 2011; Doğan et al., 2014; Faiz & Kamer, 2017; Kardeş et al., 2017; Kaya, 2011; Kozikoğlu, 2018; Leblebici & Çeliköz, 2017), the acquisition of material design skills (Bilir Seyhan & Arslan Cansever, 2017) and the investigation of the pre-school undergraduate program in terms of CR (Türkoğlu & Gültekin Akduman, 2013). It is considered that a study on the development of the Children's Rights Education Curriculum (CREC) for PPTs will contribute to filling the gap in the relevant literature, will provide information as a model application regarding how CRE can be realized in preschool teacher training programs and will be an important resource for curriculum development studies to be performed for CRE in the pre-school teacher training period. In line with the reasons stated, in this study, it was aimed to prepare, implement and evaluate the Children's Rights Education Curriculum (CREC) for PPTs. In accordance with this main aim, answers were sought to the following sub-questions:

What is the effect of the CREC on the understanding of PPTs related to the concept of the violation of children's rights, children's rights and UN Convention on the Rights of the Child?

Is there a significant difference between PPTs' attitude scores towards children's rights before and after the CREC?

Is there a significant difference between PPTs' attitude scores towards children's rights education before and after the CREC?

What is the effect of the CREC on PPTs' activity planning and material designing skills for children's rights education?

How do PPTs evaluate the effectiveness of the CREC and the effect of the CREC on their individual development for children's rights and children's rights education?

Method

Research Model

The explanatory sequential design, one of the mixed method research designs, was used in this study in which it was aimed to prepare, implement and evaluate the effect of CREC for PPTs. In explanatory sequential design, qualitative data are collected and

analyzed after quantitative data are collected and analysed (Christensen, Johnson, & Turner, 2011; Creswell & Plano Clark, 2011). The qualitative stage is used to explain the relationships, orientations, and results in the quantitative stage. In this study, quantitative data were first collected and analyzed and then qualitative data were collected and analyzed. The quantitative dimension of the study was modelled as a single group pre-test-post-test experimental design, and the qualitative dimension was modelled as a case study. In the quantitative dimension of the study, training was provided to 42 PPTs for 28 weeks with the CREC. The data collection tools in relation to CR and CRE were applied as pre-test and post-test. Thus, quantitative data on the effect of the CREC on CR and CRE were collected. In the qualitative dimension, the opinions of PPTs were taken for them to evaluate the CREC and their personal development after the quantitative dimension was completed. Thus, it was aimed to support and detail the quantitative data obtained for the effectiveness of the CREC with qualitative data.

Participants of the Research

Participants for quantitative data. The participants in which experimental study was carried out consisted of 42 PPTs studying at the second grade of a state university in the South eastern Anatolia Region of Turkey. The study was carried out on second grade PPTs due to the presence of an elective course called "children's rights" at the second grade level in the spring semester. The age of PPTs varies between 18 and 20, and all of them are female. Furthermore, none of the PPTs received any training on CR and CRE before and performed any individual study. In the study, participant numbers between 1-42 were defined for these PPTs.

Participants for qualitative data. The participants for interview were created from the study group for qualitative data by the criterion sampling method, one of the purposeful sampling methods. In this process, it was taken as a basis that PPTs participated in the entire CREC implementation process, volunteered and had different levels of knowledge, skills, and attitudes related to CR and CRE after the experimental procedure. The saturation point was taken as a basis in determining the number of participants. In this context, 13 PPTs who differed in terms of knowledge, attitudes, and skills related to CR and CRE constituted the study group of the research. The participant numbers for these PPTs were not defined again, the participant numbers given in the beginning were used.

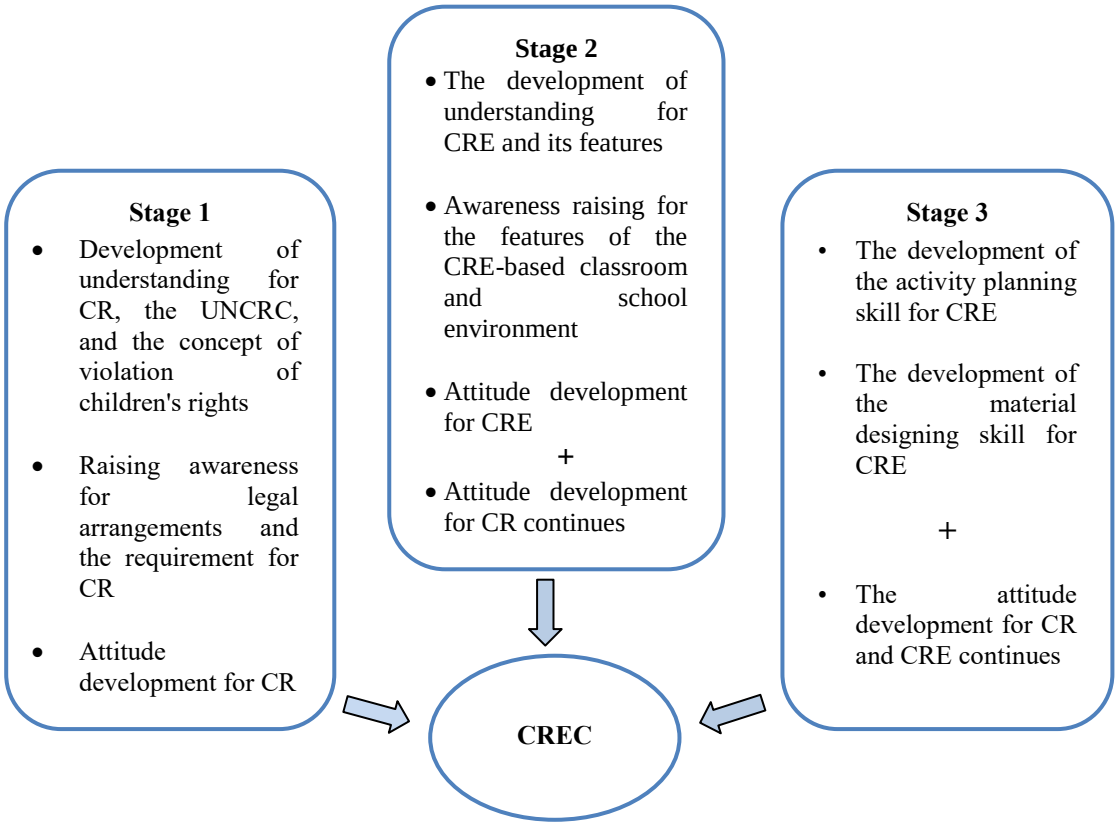
The Process of Preparation and Implementation of the CREC

Needs analysis studies. A needs analysis was first performed in the process of preparation of the CREC. In needs analysis studies, the data were obtained from three sources, being preschool teachers, PPTs and the findings of the literature. In this process, a focus group discussion was held with two different groups of eight people that consisted of PPTs studying at the fourth-grade level. In a similar way, a focus group discussion was held with two different groups of eight people that consisted of pre-school teachers with different experience and type of the school worked. Moreover, information was collected on which knowledge and skills should be attained for CRE with the literature review. The need was put forth by evaluating the data collected from these three sources together. In this process, PPTs' deficiencies with regard to knowledge, skills, and

attitudes for CR and CRE were determined. Furthermore, the knowledge, skills, and attitudes related to CR and CRE that were considered important/necessary to be acquired were determined. These findings obtained were used in the process of determining the objectives for the CREC and formed a basis for designing the structure of the CREC.

Determination of the objectives and development and implementation of activity plans for the CREC. The general objectives and acquisitions for the CREC were prepared by taking expert opinions in accordance with the findings of the needs analysis. Following this, studies were carried out to determine the stages of application and develop activities to fulfil these objectives. Three stages were determined for the CREC in this context. The activity plans were prepared in accordance with the relevant literature findings and expert opinions. A pilot study was performed before the implementation of the activity plans prepared. The stages of the application of the CREC are presented in Figure 1.

Figure 1. Structure and Stages of the CREC



The stages of the CREC and the studies conducted in the process of implementing these stages can be summarized as follows:

Stage 1. In the first stage of the CREC, it was aimed to conduct studies on developing an understanding of CR, the concept of the violation of children's rights and the UNCRC, raising awareness of legal arrangements for CR and the necessity of these arrangements, and developing attitudes towards CR. In accordance with this objective, activities were planned for the development of the knowledge, awareness and attitudes and applied for eight weeks. In this process, the activities were performed by using

research and investigation studies, cooperation-based learning studies, practices based on the critical thinking skill, whole class discussion, case study and media news review. Furthermore, the help of a legal expert was sought in the studies of raising awareness for the violations of children's rights, legal arrangements for CR, and the necessity of these arrangements. In this process, information studies and studies of answering questions were carried out using case studies for the creation of awareness and knowledge.

Stage 2. In the second stage of the CREC, it was aimed to create knowledge and raise awareness of CRE, its features and importance, and the process of creating a CR-based structure in the classroom environment. Furthermore, studies were carried out for the attitude development for CRE in this stage, and the attitude development studies for CR were maintained at the same time. The practice was performed for six weeks in this stage. In this process, activities were performed by employing the methods and techniques used in the first stage. In addition to this, PPTs were sent to schools for observation following the theoretical study on the CR-based classroom and school features. Information exchange was made in the classroom following the observation studies held as a group. Hence, the opportunity was provided to evaluate the physical arrangements and practices in the real classroom and school environments in terms of CR.

***Stage 3*.** In the third stage of the CREC, it was aimed to introduce knowledge and skills in relation to activity preparation and material designing for CRE. Furthermore, the attitude development studies for CRE and CR were maintained. Practice was performed for 14 weeks in this stage. In this process, activity preparation skill development studies were performed for CRE for ten weeks. In six of these ten weeks, it was attempted to practically teach how active learning activities based on cooperative studies such as the use of drama, stories and fairy tales, playing cards, drawing, educational games, story completion or creation, etc. can be used in CRE. As for the following four weeks, practices were performed to gain competence in relation to the process of developing an activity plan (goal setting, method and technique selection, organization and evaluation processes). Afterwards, a four-week workshop was held to introduce the material developing skill for CRE. In this process, reminding studies were performed, and sample designs were discussed since PPTs had prior knowledge about the material development process. Moreover, information was given about goal setting regarding the materials and the features that the materials should have. Two faculty members who are experts in their field were asked for their opinion to check the suitability of the materials prepared for CRE. Following this, these materials prepared were exhibited at the Pre-school Teaching Material Exhibition. After the exhibition, the PPTs were given the certificate of participation in the exhibition.

Data Collection Instruments

Scale for the Attitude towards Children's Rights (SACR). The Scale for the Attitude towards Children's Rights (SACR) developed by Karaman-Kepenekci (2006) was used to determine the effect of the CREC on the attitudes of PPTs towards CR. The SACR that consists of a single factor incorporates 22 items related to the vital, developmental, protection and participation rights of children. Example items of SACR are as follows: "I believe that the most basic right of the child is the right to live", "The

state must protect the child from all forms of ill-treatment", "I believe children should be protected from wars". In the process of developing the test, it was determined that the item-total correlation coefficients varied between .32 and .61, the Cronbach Alpha internal consistency coefficient was .85, and the half-test reliability coefficient was .77. In this study, the SACR was used by performing a reliability study. The Cronbach Alpha coefficient was calculated to be .96.

Understanding Development Assessment Form (UDAF). After the implementation of the CREC, the UDAF was used to determine whether it created a change in the understanding of PPTs in relation to CR, the violation of children's rights and the UNCRC. The UDAF includes seven open-ended questions aimed at revealing the relevant understanding (see: Table 6). The UDAF was prepared in accordance with the findings of the literature and expert opinions. Furthermore, a pilot study was performed before the practice.

Activity Planning Skill Assessment Form for CRE (APSAF). Data were collected using the APSAF to determine the effect of the CREC on the activity planning skills of PPTs for CRE. In this context, PPTs were asked to plan an activity for CRE in the APSAF.

Material Designing Skill Assessment Form and Material for CRE (MDSAF+M). Data were collected to determine whether a change occurred in the material designing skills of PPTs for CRE following the CREC. In the MDSAF pre-test process, they were asked whether they could develop materials for CRE and to give information about that material if they could design one. If there were PPTs who answered positively in this stage, it was planned to wait for them to design the materials by giving them time before the CREC. The MDSAF was applied after the practice, and the materials developed were evaluated.

Scale for the Attitude towards CRE (ATCRE). The ATCRE developed by Öztürk and Doğanay (2017a) was used to determine whether a change occurred in the attitudes of PPTs towards CRE after the practice. A scale structure that consists of 20 items and 3 factors was achieved as a result of the AFA in the development process of the ATCRE. These factors were "Attitude towards acquiring information on children's rights education" (factor 1), "Attitude towards children's rights education applications" (factor 2) and "Attitude towards popularizing children's rights education" (factor 3). The factor 1 includes seven items, item factor loads vary between.722 and .874, item-total correlations vary between .762 and .911. Example items of this factor are as follows: "I like participating in discussions on children's rights education", "Books, articles etc. publications on children's rights education attract my attention", "Children's rights education is an area that I wish to develop myself in". The factor 2 includes nine items, item factor loads vary between .661 and .899, and item-total correlations vary between .685 and .926. Example items of this factor are follows: "I believe that a children's rights based culture should be developed in schools", "Courses on children's rights education should be included in teacher development curricula". The factor 3 includes four items, item factor loads vary between .729 and .850 and item-total correlations vary between .829 and .914. Example items of this factor are follows: "I believe that studies should be

carried out for increasing the awareness of families for an effective children's rights education", "I would like to increase my knowledge on children's rights education and to share this knowledge with people around me". It was determined that the three factors determined explain 68.188% of the total variance. CFA was carried out in order to check the validity of the construct acquired as a result of EFA. It was determined from the CFA fit indexes that GFI(.90), AGFI(.88) and NFI(.93) are at acceptable fit levels whereas X2/sd(CMIN/DF) (1.234), CFI(.99), IFI(.99), RMSEA(.039), SRMR(.039) are at perfect fit levels. The Cronbach Alpha value of the scale was calculated to be .914. Cronbach Alpha coefficients for the sub-factors of the ATCRE are .902 (factor 1), .930 (factor 2), .881 (factor 3). In this study, the ATCRE was used by performing a reliability study. The Cronbach Alpha coefficient was calculated to be .94

Evaluation Form for Views Regarding Effectiveness of CREC and Individual Development (EFVEC). The EFVEC was used to get the opinions of PPTs on the effectiveness of the CREC and evaluate whether a change occurred in the knowledge, skills and attitudes in relation to CR and CRE at the end of the process. The EFVEC includes five open-ended questions prepared in accordance with expert opinions. The EFVEC reached its final state after pilot implementation.

Data Collection

This study was carried out in the spring and fall semesters of the 2016-2017 academic year. Two course hours of practice per week were performed for 28 weeks during the process of the CREC in the study. The SACR, ATCRE, UDAF, APSAF and MDSAF+M were applied as a pre-test and post-test. The EFVEC was applied after the practice.

Data Analysis

Analysis of the SACR and ATCRE data. The data collected with the SACR and ATCRE were analysed by conducting the paired samples t-test in the quantitative data statistics program. The preliminary assumptions of the paired samples t-test were checked in the analysis process.

Analysis of the UDAF data. The analysis framework used by Ekiz and Akbaş (2005) in their studies was used in the analysis of the UDAF data. In this context, the UDAF data were analysed according to five levels of understanding (Table 1).

Table 1

Understanding Levels for the Analysis of the UDAF Data

Levels	Scopes
Understanding (U)	It includes the answers that incorporate all the aspects of the scientific answer to the question.
Limited Understanding (LU)	It covers the answers that incorporate one or more aspects of a valid scientific answer, but not all of them.
Failure to	Repeating the question exactly as it is, and irrelevant or inexplicit answers are

Understand (FU)	covered by this category.
Misunderstanding (MU)	Answers that are alternative to valid scientific answers, i.e. answers that do not fit scientific facts are collected in this category.
Inability to Answer (IA)	Leaving blank, or answers such as "I don't know" or "I forgot" are covered by this category.

Analysis of the APSAF Data. A two-stage process was followed in the analysis of the APSAF data. In the first stage, the analysis was performed by using the Children's Rights Education Activity Plan Assessment Rubric (CREAPAR) created with expert opinions (See: Table 2). Four components, namely goal setting, selection of suitable teaching methods and techniques, application process and organization and evaluation process were taken into consideration in the CREAPAR. Four performance levels varying between 0 and 3 were determined for each component.

Table 2

Children's Rights Education Activity Plan Assessment Rubric

Performance Level	Goal Setting	Selection of Suitable Teaching Methods and Techniques	Application Process and Organization	Evaluation Process
3	The goals were set in accordance with CRE and developmental characteristics of children.	Methods and techniques suitable for the goal determined for CRE and the level of the development of children were selected.	In the application process, the links to children's rights were clearly specified, and detailed information was given on how to organize the process.	The evaluation process was structured in accordance with the goal set regarding CRE and in accordance with the developmental characteristics of children.
2	The goals are suitable for CRE, but the suitability of one of the goals for the developmental characteristics of children is not clear.	Methods and techniques suitable for the goal determined for CRE and partially suitable for the level of the development of children were selected.	In the application process, the links to children's rights were clearly specified, and partial information was given on how the process could be organized.	The evaluation process was structured in accordance with the goal set regarding CRE and partially in accordance with the developmental characteristics of children.

1	The goals are suitable for CRE, but not suitable for the developmental characteristics of children.	Methods and techniques suitable for the goal determined for CRE and not suitable for the level of the development of children were selected.	In the application process, the links to children's rights were clearly specified, and no information was given on how the process could be organized.	The evaluation process was prepared in accordance with the goal set regarding CRE, but not structured in accordance with the developmental characteristics of children.
0	The goals are not suitable for CRE and the developmental characteristics of children.	Methods and techniques not suitable for the goal determined for CRE and the level of the development of children were selected.	In the application process, no clear information was given on the links to children's rights and how to organize the process.	The evaluation process was not structured in accordance with the goal set regarding CRE and the developmental characteristics of children.

In the second stage, skill levels in relation to activity planning were created in accordance with expert opinions starting from the performance levels related to the components. These five skill levels are presented in Table 3.

Table 3

Activity Planning Skill Levels for CRE

Levels	Scopes
Very Good	The performance level of all components is three.
Good	The performance level of the components varies between 3 and 2.
Medium	The performance level of all components is two.
Needs improvement	The performance level of one of the components is 0* or 1*, while the others are above 1.
Weak	• The performance level of at least two of the components is 1 or 0. • The performance level of the component of goal setting is 1 or 0.

**The performance levels 0 and 1 cannot present in the component of goal setting*

Analysis of the Material Designing Skill Assessment Form and Material (MDSAF+M) Designed for CRE. A two-stage process was followed in the analysis of the MDSAF+M data. In the first stage, the analysis was performed by using the Material Assessment Rubric for Children's Rights Education created with expert opinions (See: Table 4). In the MDSAF+M, four components were taken into consideration, namely goal setting, suitability of the material for CRE and the level of children, the organization of the application process and ensuring the participation, suitability for design elements and practicality. Four performance levels varying between 0 and 3 were determined for each component. In the second stage, skill levels in relation to material development for CRE were analysed in accordance with expert opinions starting from the performance levels related to the components. The Activity Planning Skill Levels Analysis Structure for CRE

(See: Table 3) was used in the analysis of skill levels. In this context, five levels, being very good, good, medium, needs improvement and weak, were used for the material developing skill.

Table 4

Material Assessment Rubric (MAR) for CRE

Performance Level	Goal Setting for the Material	Suitability of the material for CRE and the Level of the Development of Children	Organization of the application process and ensuring the participation	Suitability for Design Elements and practicality
3	The goals for the material were determined in accordance with CRE and developmental characteristics of children.	It is suitable for the goal set for CRE and the developmental level of children.	The material was designed in such a way that it ensured the participation of children, and sufficient explanation was made on how the material should be used to ensure the participation of children.	The material was structured in accordance with the design elements, and it is practical.
2	The goals for the material are suitable for CRE, but the suitability of one of the goals for the developmental characteristics of children is not clear.	It suits the goal set for CRE, and it is partially suitable for the developmental level of children.	The material was designed in such a way that it ensured the participation of children, and partial explanation was made on how the material should be used to ensure the participation of children.	The material was structured partially in accordance with the design elements, and it is practical.
1	The goals for the material are suitable for CRE, but they are not suitable for the developmental characteristics of children.	It is suitable for the goal set for CRE, but it is not suitable for the developmental level of children.	The material was designed in such a way that it ensured the participation of children, but no sufficient explanation was made on how to use the material to ensure the participation of children.	The material was not structured in accordance with the design elements, but it is practical.
0	The goals for the material are not suitable for CRE and the developmental characteristics of	It is not suitable for the goal set for CRE and the developmental level of children.	The material was not designed in such a way that it ensured the participation of children, and no sufficient explanation	The material was not structured in accordance with the design elements, and it is not practical.

	children.	was made on how to use the material to ensure the participation of children.

**For the activities that have more than one goal*

Analysis of the EFVEC Data. The qualitative data collected with the EFVEC were analysed using the content analysis. The clear and selective coding process (Strauss & Corbin, 1990), which is the first stage of the content analysis, was followed in the analysis stage. In this process, the transcript was examined line-by-line, and the codes were created based on the meanings that emerged directly or indirectly. Then, the categories were created by bringing together the codes with similar features. Five categories were achieved as a result of the analysis.

Reliability and Validity Studies for the Analysis of Qualitative Data

The research sample and processes were defined in detail. Quotations were included in the study in order to refresh the inferences made in the minds of readers. Coder reliability was used in order to ensure the reliability of the results achieved in the content analysis and descriptive analyses. Accordingly, a team consisting of three people, experts in their fields and a researcher, was created for each analysis. Simultaneous analyses were conducted, and the codes were compared. Consensus was reached by discussing the divergent codes with the experts.

Results

Results on the Development of Attitudes towards CR and CRE

In the study, the SACR and ATCRE scores were investigated by performing the paired samples t-test to determine whether the attitudes of PPTs towards CR and CRE changed after the CREC (Table 5).

When the results related to the SACR in Figure 5 are examined, it is observed that the PPTs' SACR post-test scores after the CREC significantly increased when compared to the SACR pre-test scores [$t(41)=38.67$, $p<.05$]. While the SACR average pre-test score of PPTs was $\bar{X}=75.50$ before the CREC, it is observed that the average post-test score increased to $\bar{X}=108.83$ after the CREC. In this context, it can be said that PPTs' attitudes towards CR increased after the CREC and that the CREC had a positive effect on PPTs' attitudes towards children's rights.

The results related to the ATCRE in Table 5 show that the SACRE post-test scores of PPTs after the CREC changed by increasing significantly when compared to the ATCRE pre-test scores [$t(41)=40.20$, $p<.05$]. While the ATCRE average pre-test score of PPTs was $\bar{X}=52.66$ before the CREC, it is observed that the SACRE average post-test score increased to $\bar{X}=94.30$ after the implementations. Accordingly, it can be said that PPTs' attitude scores towards CRE increased after the CREC and that the CREC had a significant effect on the development of positive attitudes towards CRE.

Table 5

Paired Samples t-test Results of the SACR and ATCRE Pre-test and Post-Test Average Scores

Scales	Measure	*N*	$\bar{X}$	*S*	*sd*	*t*	*p*
SACR	Pre-test	42	75.50	5.20	41	38.67	.00
	Post-test	42	108.83	1.83			
ATCRE	Pre-test	42	52.66	3.94	41	40.20	.00
	Post-test	42	94.30	5.94			
ATCRE Factor 1	Pre-test	42	13.19	2.40	41	40.89	.00
	Post-test	42	33.16	2.51			
ATCRE Factor 2	Pre-test	42	28.97	2.86	41	23.97	.00
	Post-test	42	41.90	2.93			
ATCRE Factor 3	Pre-test	42	10.50	2.60	41	19.32	.00
	Post-test	42	19.23	1.18			

In the study, the paired samples t-test was applied for “Attitude towards acquiring knowledge on children’s rights education” (factor 1), “Attitude towards children’s rights education applications” (factor 2) and “Attitude towards popularizing children’s rights education” (factor 3) which are the sub-factors of the ATCRE. The results related to the sub-factors of the ATCRE showed that the post-test scores of PPTs related to the sub-factors of the ATCRE changed significantly compared to their pre-test scores before the CREC [For factor 1 $t(41)=40.89$, $p<.05$; For factor 2 $t(41)=23.97$, $p<.05$; For factor 3 $t(41)=19.32$, $p<.05$] . Also, the static analyses revealed that while the factor 1 average pre-test score of PPTs was $\bar{X}=13.19$, the average post-test score increased to $\bar{X}=33.16$. While the factor 2 average pre-test score of PPTs was $\bar{X}=28.97$, it is observed that the average post-test score increased to $\bar{X}=41.90$. While the factor 3 average pre-test score of PPTs was $\bar{X}=10.50$, the average post-test score increased to $\bar{X}=19.23$. In this context, it can be said that CREC had a positive effect on PPTs' attitude towards acquiring knowledge on CRE, popularizing CRE and CRE applications.

Results on the Development of Understanding Violation of Children's rights, CR and the UNCRC

The results on the change in understanding of PPTs in relation to the concept of the violation of children's rights, CR and the UNCRC before and after the practice are presented in Table 6.

Table 6

Findings on the Development of Understanding

Questions		U		LU		FU		MU		IA	
		F	%	F	%	F	%	F	%	F	%
What do you think children's rights are?	Pr-T	0	0	36	85.71	6	14.29	0	0	0	0
	Ps-T	42	100	0	0	0	0	0	0	0	0
What are the main principles of the UNCRC?	Pr-T	0	0	0	0	0	0	0	0	42	100
	Ps-T	41	97.61	1	2.39	0	0	0	0	0	0
How do you explain the violation of children's rights?	Pr-T	0	0	27	64.29	0	0	0	0	15	35.71
	Ps-T	42	100	0	0	0	0	0	0	0	0
What do you think the participation rights of children are?	Pr-T	0	0	13	30.95	0	0	0	0	29	69.05
	Ps-T	42	100	0	0	0	0	0	0	0	0
What do you think the protection rights of children are?	Pr-T	0	0	5	11.90	0	0	0	0	37	88.10
	Ps-T	42	100	0	0	0	0	0	0	0	0
What do you think the development rights of children are?	Pr-T	0	0	2	4.76	0	0	14	33.33	26	61.91
	Ps-T	42	100	0	0	0	0	0	0	0	0
What do you think the rights to live of children are?	Pr-T	0	0	11	26.19	31	73.81	0	0	0	0
	Ps-T	42	100	0	0	0	0	0	0	0	0

**Pr-T: Pre-test, Ps-T: Post-test*

Upon examining Table 6, it is observed that the explanations made by PPTs on CR before the CREC remained at the level of LU to a great extent. Accordingly, it was observed that PPTs made explanations with limited expressions such as "*The rights that children have*" (T6), and "*The rights that protect children*" (T2). After the CREC, it was determined that all the PPTs gave answers at the level of understanding. In these answers, it was observed that explanations that included distinctive features such as being universal, and ensuring recognition, protection, life, development and participation to all children were made. The findings on the principles of the UNCRC showed that none of the PPTs could answer before the CREC, and they all gave answers at the level of understanding after the CREC, except for one of them. In these answers, it was determined that they made explanations based on four main principles, being the

prohibition of discrimination, right of participation, the best interest of the child, and the right to live and development of children. It was observed that PPTs either made explanations at the limited understanding level or failed to answer before the CREC regarding the concept of the violation of children's rights. It was observed in the answers given at the limited understanding level that they made general explanations such as depriving children of their rights. After the CREC, it was observed that all of them explained the concept of the violation of children's rights by giving examples of its characteristic features. Accordingly, it was observed that they tried to explain it as a loss of rights that occurs due to unjust intervention, attitude or deficiency that directly or indirectly result from the state (public) power towards children's rights. Hence, it was observed that they made explanations by pointing to the fact that the respondent of an individual during the process of the loss of right is the state and the loss of right results from the state (public) power. Categorical evaluations were made to be able to investigate the development of understanding in relation to the rights in the UNCRC in detail. Among them, the findings on the participation rights of children showed that 29 of the PPTs failed to make any explanation by stating that they had not heard or known about such a right before the practice. It was observed that 13 of them made explanations at the limited understanding level by saying that it was the ability of a child to express his/her opinion by participating in the lesson. After the CREC, it was observed that all of them provided information at the understanding level. In this context, it was observed that they made explanations with items related to different contexts such as children's expressing their opinions, participating in the decision processes about themselves, establishing an association, participating in game and entertainment activities, participating in the process of environmental protection, and the access to mass communication tools and other sources of information. It was also determined that they gave information about educational reflections in these explanations. It was observed in the study with regard to protection rights that five of the PPTs made limited explanations before the practice in the form of protecting children against violence and abuse. After the practice, it was determined that they all made explanations at the level of understanding. Accordingly, it was determined that they made explanations in different contexts such as protecting children against any neglect, abuse and exploitation, child labour, substance dependence, rights of refugee children, and being protected against war and armed conflicts. The findings on development rights showed that PPTs either generally failed to answer or gave answers at the level of failure to understand before the practice. In the answers given at the failure to understand level, it was observed that they gave answers that were not directly related such as "children have the right to develop in periods when the development is rapid". However, it was observed that they made explanations that incorporated the freedom of education, game, resting, getting information, and religion, conscience and thought after the practice. The findings on the rights to live showed that PPTs mainly gave answers at the level of failure to understand or limited understanding before the CREC. Accordingly, it was observed that they gave unclear answers by repeating the question such as "… *is children's right to live*" (T13) at the level of failure to understand. At the level of limited understanding, it was observed that they gave partially explanatory answers such as *"…to live is the most basic human right, and what is necessary should be done for children to live. I think it is to do what is necessary for their nutrition*" (T5), although not with all its dimensions. It is observed that all the PPTs

made explanations at the level of understanding after the CREC. In this direction, it was determined that PPTS made explanations that incorporated the basic needs of children such as to live, have suitable living conditions, nutrition, shelter and health.

When the results are evaluated in general, it can be said that PPTs obtained information at the level of understanding at high rates on the concept of the violation of children's rights, CR and the UNCRC after the CREC.

Results on the Activity Developing Skill in Relation to CRE

In the study, the PPTs were asked to develop activity plans to determine whether there was a change in the activity planning skill for CRE before and after the CREC. The performance level findings on the activity planning skill for CRE of the PPTs are presented in Table 7.

Table 7

Results on the Performance Level of the Activity Plan Developing Skill for CRE

Measure	Performance Levels									
	Very good		Good		Medium		Needs Improvement		Unsuccessful	
	f	%	f	%	f	%	f	%	f	%
Pre-Assessment	0	0	0	0	0	0	0	0	42	100
Post-Assessment	8	19.05	14	33.33	17	40.48	3	7.14	0	0

Upon examining Table 7, it is observed that none of the PPTs could develop an activity plan for CRE before the CREC. In the data collection process before the CREC, PPTs stated that they could not develop an activity since they had not received such training and did not have the sufficient knowledge on CR. After the practice, it was observed that 39 (92.86%) of the PPTs developed activities at the level that can be regarded as successful. Nevertheless, it is observed that they exhibited performances of low competence in the process of developing activities for CRE. The findings show that PPTs who exhibit sufficient performance in terms of the activity plan developing skill can generally define goals that fit the level of the development of children for CRE, organize the process by selecting methods and techniques that fit these goals, and give information on how to establish a connection with the rights in the application process and the evaluation process. Upon investigating the methods and techniques preferred in activities, it was determined that they mainly developed activity plans in which they would use creative activities such as drawing and story completion with drama, story and fairy tales, and educational games, and the materials they developed. It was observed that they prepared activities for realizing the acquisition related to a single right in some of these plans, and more than one right in the others. For example, discrimination against refugee children (race-based discrimination) was taken as a basis in the activity named "Far away from my country". In the activity in which emotion masks were used, it was planned to have students find correct behaviours through empathising starting from the story of an ostracized refugee child. Furthermore, it was aimed to raise awareness of the rights of shelter, nutrition, education, game and entertainment of children in the activity named

"One day of mine". In the activity that was planned to be held with the group study and playing cards, it was planned to carry out an activity with the playing cards showing the activities that children do in a day (having a meal, going to school, playing games and returning home), and the question and answer technique. It was determined that those PPTs that failed to show sufficient performance remained insufficient especially in the process of application and evaluation processes in the activities they developed. In this context, it was observed that they failed to select suitable methods and techniques, failed to explain how to organize the process of application, and did not give detailed information on how to realize the process of evaluation.

Results on the Development of the Material Designing Skill for CRE

In the study, data were collected before and after the practice to determine whether the CREC had any effect on the development of the material developing skill of PPTs for CRE. The results showed that none of the PPTs had the material developing skill for CRE before the CREC. With regard to this, PPTs stated that they did not have the required competence to develop materials for CRE before the CREC. The materials developed by PPTs to determine the development of the material designing skill for CRE after the practice and the reports on the materials (MDSAFs) were examined. In this process, the materials developed were scored according to the MAR. Based on these scores, the material designing skills of PPTs for CRE were determined. Accordingly, it was determined that 7 of the PPTs had the skill at a very good level, 12 at a good level, 8 at a medium level, 9 at a level of needs improvement, and 6 had the skill at a weak level. Again, as a result of these investigations, it was determined that 27 of the materials developed could be used for CRE in the pre-school period. The examples of the materials developed are presented in Figure 2.

Figure 2. Examples of the Materials Developed for CRE

The examinations made on the materials showed that the types of the materials developed were designed in different types such as children's rights books, playing cards, the rights tree, the rights train (together with rights cards), rights house, rights clock (it is based on gender equality when teaching the rights), head in hole board with rights cards, rights bridge, rights doll (created for equality and the prohibition of discrimination), and models created for teaching children's rights. It was also determined that the rights that were aimed to be taught to children in materials varied. For example, while the rights doll was created for equality and the prohibition of discrimination, the flight to rights material was created to protect children against war and provide them with sufficient life standards, and raise awareness of the rights of refugee children. The rights clock aimed to teach rights such as the right to game and entertainment and right to education with a gender equality-based approach with the pictures of girls and boys placed on the hour and minute hand.

When the results on the material designing skill are investigated in general, it can be said that a significant part of the PPTs could develop materials of sufficient quality for CRE after the CREC.

Results for Views Regarding Effectiveness of CREC and Individual Development

In the study, PPTs were asked to evaluate the effectiveness of CREC and individual development. The results are presented in Table 8.

Table 8

Results for Views Regarding Effectiveness of CREC and Individual Development

Categories	Codes
Information acquisition on CR and the UNCRC	Gaining the conceptual understanding of CR
	Gaining information on the UNCRC
	An increase in the number of the rights known
	Providing permanent information on CR
	Gaining contemporary information on CR
	Gaining an understanding of the violation of children's rights
Awareness raising for the importance and protection of CR	Gaining awareness of how to protect children
	Comprehending the importance of the UNCRC
	Gaining awareness of the importance of CR
	Comprehending the necessity of legal arrangements for CR
	Gaining awareness of what to do in case of the violation of CR
	Realizing the rights that are not provided to the child
	Realizing the importance of defending CR
	The ability to make a violation and crime analysis regarding CR

Findings on the necessity of the CREC and the benefits it provides	Contributing to professional development
	Ensuring that the relationship between CRE and real life is understood
	Building the sense of responsibility in relation to CR
	Introducing positive attitudes towards one's profession
	Developing knowledge, skills and attitudes for CRE
	Providing information about the violation of children's rights, CR and the UNCRC
	Raising awareness of the importance of CR and the UNCRC
Building attitudes, knowledge and skills for CRE	Developing the material designing skill for CRE
	Gaining positive attitudes towards CRE
	Realizing the features of the learning environments that are suitable for CR
	Gaining the activity planning skill for CRE
Findings on behaviour development for CR	Investigating the associations and institutions that work on CR
	Following the news in the media about CR
	Approaching CR-related situations in daily life in a more conscious manner
	Being more sensitive towards street children and approaching them in a more conscious manner
	Conducting research on CR practices in Turkey and around the world

Upon examining Table 8, it is observed that the results on evaluating the effectiveness CREC and individual development are gathered under five categories. Within the scope of information acquisition on CR among these, PPTs stated that development occurred following the CREC in their conceptual understanding of CR and the violation of children's rights, their current knowledge of children's rights, their knowledge of the UNCRC and the number of the rights they know. They also stated that they gained permanent knowledge of CR. Among these, an increase in their knowledge about the UNCRC and the number of the rights they know was expressed by (T12) among the PPTs as follows: "… *I learnt and understood the UNCRC in a more detailed way, and I obtained in-depth knowledge about the number of the articles I know and the scope of the practices*…"

In the context of raising awareness of the importance and protection of CR, PPTs stated that they gained awareness of how to protect children, what can be done in case of the violation of CR, the importance of CR and the UNCRC, and the necessity of legal arrangements for CR. They also stated that they could realize the rights that cannot be provided to children, the violations and crimes related to CR and developed courage for defending CR. Among them, one of the PPTs (T2) stated the development of courage for defending CR as follows:

> "In the past, I could not say anything when I saw a child who was exposed to the violation of rights because I was shy to say something. But now I have become conscious, and I know that I will speak no matter what."

Another PPT said the following about the necessity of legal arrangements:

> "….it was something that I inquired and was curious about much. Why do all the children in the world not benefit from children's rights equally if they exist? I have understood the necessity and importance of legal arrangements for these rights in their own countries for the protection of children's rights…" (T5).

The results on the necessity of the CREC and the benefits it provides showed that all the PPTs find the practices necessary. Accordingly, PPTs stated that the practices contribute to their professional development, provide positive attitudes towards their profession, introduce the sense of responsibility in relation to CR, raise awareness of the importance of CR and the UNCRC, develop competence for CRE, and help them understand the relationship between CRE and real life. Among them, (T11) stated the acquisition of positive attitudes towards the profession as follows "…*I learnt that my profession is seriously holy*…" The contribution made to professional development is expressed by one of the PPTs (T17) as follows: "*the practices have become very beneficial for me, as a pre-service teacher, and contributed significantly to my professional development…*"

In the context of creating attitudes, knowledge and skills for CRE, PPTs stated positive attitudes towards CRE, and that they gained the activity planning and material designing skills for CRE. They also stated that they realized the features of the learning environments that are suitable for children's rights. One of the PPTs said the following in relation to this:

> "…I understood the necessity of CRE and did not only understand but also gained information on how to ensure this education…what is more important was to sustain children's rights…I realized the features of the learning environments that are suitable for CR…finally, we designed a material, when we did this, my self-confidence that I can do it for CRE increased…" (T34)

Within the scope of the findings on behaviour development, PPTs stated that they conduct research on CR, follow the media and exhibit more sensitive reactions. One of the PPTs (T7) expressed the fact of conducting research on CR practices as follows "…*I was not curious about the practices and violations of children's rights in our country and in the world before the practice. I started to investigate after the practice…*"

Discussion and Conclusion

The research results showed that PPTs obtained various acquisitions in relation to the attitude, knowledge and skills development for CR and CRE after the CREC. Within the scope of attitude development among these, it was observed that the attitudes of PPTs towards CR and CRE changed in a positive way after the CREC. The attitudes and beliefs of teachers in relation to CR and CRE play a significant role in the effective realization of CRE. In this context, various negative beliefs and attitudes among teachers such as not believing in the necessity of CR and CRE, considering them as a threat against their authority, not considering CRE as a part of their profession, and not being willing to conduct studies for CRE were determined among the problems encountered in the application process for effective CRE (Howe & Covell, 2007; Öztürk, Eren, & Topçu, 2017). In this framework, it can be said that it is important to introduce pre-service teachers with positive attitudes towards CRE for effective CRE (Öztürk & Doğanay, 2017a). Accordingly, it can be said that the positive increase in the attitudes of PPTs towards CR and CRE in the study is an important acquisition. When the effect of information acquisition in relation to CR and the UNCRC on the development of a positive attitude towards CR and CRE is considered (Leblebici & Çeliköz, 2017), it can

be said that one of the factors contributing to the development of attitude in the CREC process is the information acquisition in relation to CR and CRE.

The other research results showed that information acquisition occurred in PPTs in relation to CR and the UNCRC after the CREC. In this context, it was determined that an increase was ensured in the conceptual knowledge of PPTs about CR, and their knowledge of the structure and content of the UNCRC. Information acquisition in relation to CR is very important in realizing the UNCRC, and its lack may cause the ineffective implementation of the UNCRC (Robson, 2016). According to Shumba (2003), teacher's training programs should provide information on CR and the UNCRC for effective CRE. Furthermore, information acquisition of pre-service teachers on children's rights within the context of their university education is important to form a sound basis for professional working experiences in the future, to internalize children's rights and to be a model for students (Bilir Seyhan & Arslan Cansever, 2017). In this context, the fact that the development of understanding was ensured for the participation rights of children is another important situation because ensuring the participation rights of children is of great importance for them to gain democratic values and to be raised as participatory citizens (Pascal & Bertram, 2009). Nevertheless, it was observed that pre-service preschool teachers had a low level of awareness of the children's participation rights (Kardeş et al., 2017). It is mentioned that studies should be carried out in this direction. In this context, it can be said that it is a very important acquisition for CRE that PPTs have gained the understanding of CR and the UNCRC after the CREC.

The research results were also determined that developments occurred in the CRE activity preparation and material development skills of the majority of the PPTs after the CREC within the scope of the study. The professional development of teachers is very important in effective CRE. Accordingly, the lack of pedagogical knowledge of teachers is listed among the important problems for CRE (Kapai, Bacon-Shone, Walsh, & Wong, 2014; Öztürk et al., 2017). In effective education models that are suggested for CRE, it is advised to practically teach CR in environments in which children will experience the rights with activities in which they will participate actively (Alderson, 2000; Howe & Covell, 2007; Save the Children, 2006; Öztürk & Özdemir-Doğan, 2017). Considering the developmental characteristics of children in the pre-school period, it can be said that the fact that PPTs gained the knowledge and skills to be able to design materials and plan participatory activities for CRE is an important acquisition. When it is considered that drama, drawing and story completion, story and fairy tales, educational games are effective and important methods for human rights education in general and children's rights education in particular (Hassi, Niemelä, Paloniemi, Piekkari, & Wolde, 2015; Öztürk & Özdemir-Doğan, 2017), it can be said that PPTs gained important knowledge and skills for CRE. On the other hand, it is necessary to have children experience the rights they have beyond teaching them for effective CRE. In this direction, it is necessary to turn schools into places where children will experience their rights (Covell, Howe, & McNeil, 2010; Lansdown et al., 2014; Osler & Starkey, 1998; Öztürk & Doğanay, 2017b). In this research, studies were conducted to raise awareness of the CRE-based school and classroom features. PPTs stated that they obtained acquisitions in this context. PPTs also stated the CREC contributed to their professional development and provided them with positive attitudes towards their profession, created the sense of responsibility towards CR, and helped to understand the relationship between CRE and real life. A

positive or negative attitude towards the profession plays an important role in the level of the realization of goals. In this context, it can be said that the contribution of the CREC to gaining positive attitudes towards the teaching profession will support PPTs in practising their profession willingly when they start teaching, as well as effectively. On the other hand, the fact that teachers consider CR as a subject that is isolated from real life is regarded among the problems for effective CRE (Öztürk et al., 2017). In this study, it can be said that the fact that PPTs have understood the relationship between CRE and real life is a significant acquisition.

When the research results are evaluated in general, it can be said that various acquisitions in relation to CR and CRE that are regarded as important in the literature have been obtained by PPTs after the CREC. Accordingly, CREC can be proposed as a model for CRE integration in preschool teacher training programs. In the study, it has been shown that the practices performed for CR and CRE are useful for professional development of PPTs as well as knowledge, skills and attitude gaining for CR and CRE. Accordingly, it can be suggested to include lessons that will introduce conceptual knowledge and application skills for CRE in preschool teacher's training programs. It was also observed that the success of the material developing skill remained at 59% in the study. In this case, it can be suggested to perform practices for a longer term for the workshop work. On the other hand, the possibility to implement the activities and materials prepared by PPTs on preschool students could not be ensured in the study. Accordingly, the results on the effectiveness of the activities and materials developed are limited to expert opinions. In this regard, it can be suggested to carry out studies evaluating the effectiveness of the developed activities and materials in real classroom environments in practice. Also, the findings on the development related to CR and CRE within the scope of the CREC are limited to the comparison of the pre-test and post-test scores since there was no control group. In this context, it can be suggested to carry out quasi-experimental or real experimental studies that will also allow evaluation with the control group.

References

Alderson, P. (2000). School student views on school councils and daily at school. *Children and Society, 14*(2), 121-134.

Batur Musaoğlu, E., & Haktanır, G. (2012). Investigation of MONE preschool program for 36–72 months old Children (2006) according to children's rights. *Educational Sciences: Theory and Practice, 12*, 3285–3305.

Bilir Seyhan, G., & Arslan Cansever, B. (2017). Öğretmen adaylarının çocuk haklarına ilişkin algılarının materyal tasarımları ve görüşleri çerçevesinde incelenmesi. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, 1*(41), 98-119.

Brantefors, L., & Quennerstedt, A. (2016). Teaching and learning children's human rights: A research synthesis. *Cogent Education, 3*(1), 1-18.

Christensen, L. B., Johnson, B., & Turner, L. A. (2011). *Research methods, design, and analysis*. Boston, MA: Allyn & Bacon.

Coşkun, T. (2015). *Early childhood teachers' beliefs towards participation rights of children* (Unpublished master's thesis). Middle East Technical University, Turkey. Retrieved from http://etd.lib.metu.edu.tr/upload/12619051/index.pdf

Covell, K., Howe, R. B., & McNeil, J. K. (2010). Implementing children's human right education in schools. *Improving Schools, 13*(2), 117-132.

Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research* (2nd ed.). London: Sage Publications Ltd.

Değirmenci, T. (2011, Eylül). *Öğretmen adaylarının çocuk haklarına ilişkin tutumlarının incelenmesi*. XX. Eğitim Bilimleri Kurultayı, Burdur: Mehmet Akif Ersoy Üniversitesi.

Doğan, Y., Torun, F., & Akgün, İ. H. (2014). Okul öncesi öğretmen adaylarının çocuk haklarına ilişkin tutumlarının çeşitli değişkenlere göre incelenmesi. *International Journal of Human Sciences, 11*(2), 503-516.

Ekiz, D., & Akbaş, Y. (2005). İlköğretim 6. sınıf öğrencilerinin astronomi ile ilgili kavramaları anlama düzeyi ve kavram yanılgıları. *Milli Eğitim Dergisi, 165*, 61-78.

Faiz, M., & Kamer, S. T. (2017). Prospective teachers' opinions concerning children's rights. *Journal of Education and Learning, 6*(3), 118-128

Flowers, N., Brederode-Santos, M. E., Claeys, J., Fazah, R., Schneider, A., & Szelényi, Z. (2009). Compass: Manual on human rights education for children. Budapeste: Council of Europe Retrieved from http://www.eycb.coe.int/compasito/pdf/Compasito%20EN.pdf

General Teaching Council for Scotland (GTCS) (2012). Retrieved from http://www.gtcs.org.uk/web/FILES/the-standards/standards-for-registration-1212.pdf

Hassi, M. L., Niemelä, H., Paloniemi, A., Piekkari, J., & Wolde, K. (2015). Drama in child rights education-Developing a pedagogical model. *The European Journal of Social & Behavioural Sciences, 14*(3), 1902-1914.

Hodgkin, R., & Newell, P. (1998). *Implementation handbook for the convention on the rights of the child*. New York: UNICEF.

Howe, R. B., & Covell, K. (2007). *Empowering children: Children's rights education as a pathway to citizenship*. Toronto: University of Toronto Press.

Hudson, K. (2012). Practitioners' views on involving young children in decision making: Challenges for the children's rights agenda. *Australasian Journal of Early Childhood, 37*(2), 4-9.

Jerome, L., Emerson, L., Lundy, L., & Orr, K. (2015). *Teaching and learning about children's rights*. London: UNICEF.

Kapai, P., Bacon-Shone, J., Walsh, S., & Wong, F. (2014). *Children rights education: International legal framework and state party obligation*. Hong Kong Committee for UNICEF. Retrieved from http://www.law.hku.hk/ccpl/research/KapaiCREUNICEFExecutiveSummary.pdf

Karaman-Kepenekci, Y. (2006). A study of university studets' attitudes towards children's rights in Turkey. *The International Journal of Children's Rights, 14*(3), 307-319.

Kardeş, S., Banko, Ç., Eren, S., & Antakyalıoğlu, Ş. (2017). Okul öncesi öğretmen adaylarının çocuk haklarına ilişkin görüşleri. *Akademik Sosyal Araştırmalar Dergisi, 5*(54), 469-481.

Kaya, S. Ö. (2011). *Öğretmen adaylarının çocuk hakları ile ilgili görüşleri* (Yayımlanmamış yüksek lisans tezi). Afyon Kocatepe Üniversitesi, Afyonkarahisar.

Koran, N., & Avcı, N. (2017). Perceptions of prospective pre-school teachers regarding children's right to participate in classroom activities. *Educational Sciences: Theory and Practice, 17*(3), 1035- 1059.

Kozikoğlu, İ. (2018). Okul öncesi öğretmenlerinin çocuk hakları ve çocuk katılım hakkına ilişkin görüşlerinin incelenmesi. *Cumhuriyet International Journal of Education, 7*(4), 408-427. DOI: 10.30703/cije.445110.

Lansdown, G., Jimerson, S. R., & Shahroozi, R. (2014). Children's rights and school psychology: children's right to participation. *Journal of School Psychology*, *52*(1), 3-12.

Leblebici, H., & Çeliköz, N. (2017). Öğretmen adaylarının çocuk haklarına yönelik tutumları. *International Journal of Social Sciences and Education Research, 3*(1), 307-318.

Ministry of National Education (2013). *Okul öncesi eğitimi programı*. Retrieved from http://tegm.meb.gov.tr/dosya/okuloncesi/ooproram.pdf

NCSS (National Council for Social Studies). (1998). *Social studies for early childhood and elementary school children preparing for the 21st century*. Retrieved fromhttp://socialstudies.org/positions/elementary (06.02.2006).

Neslitürk, S., & Ersoy, A. F. (2007). Okulöncesi öğretmen adaylarının çocuk haklarının öğretimine ilişkin görüşleri. *Eğitimde Kuram ve Uygulama*, *3*(2), 245-257.

Osler, A., & Starkey, H. (1994). Fundamental issues in teacher education for human rights: A European perspective. *Journal of Moral Education, 23*(3), 349-360.

Osler, A., & Starkey, H. (1998). Children's rights and citizenship: Some implications for the management of schools. *The International Journal of Children's Rights, 6*(3), 313–333. http://dx.doi.org/10.1163/15718189820494085

Öztürk A., & Doğanay, A. (2017a). Development of a scale for the attitude towards children's rights education. *Educational Process International Journal, 6*(3), 26-41.

Öztürk, A., & Doğanay, A. (2017b). Çocuk hakları temelli okul ölçeğinin geliştirilmesi. *Trakya Üniversitesi Sosyal Bilimler Dergisi, 19*(1), 41-58.

Öztürk, A., & Özdemir-Doğan, G. (2017). Effective children's rights education from the perspectives of expert teachers in children's rights education: A Turkish sample. *Journal of Education and Learning, 6*(4), 303-314.

Öztürk, A., Eren, M., & Topçu, B. (2017, Mayıs). *Sınıf öğretmenlerinin perspektifinden Türkiye'de etkili çocuk hakları eğitimi: problemler ve öneriler*. V. International Eurasian Educational Research Congress, Denizli.

Pascal, C., & Bertram, T. (2009). Listening to young citizens: The struggle to make real a participatory paradigm in research with young children. *European Early Childhood Education Research Journal, 17*(2), 249–262.

Proficient Teacher Evidence Guide Early Childhood Teachers (2017). Retrieved from http://educationstandards.nsw.edu.au/wps/wcm/connect/5b21b98c-116b-4f2e-a386-56e77c48f5a8/bostes-proficient-teacher-evidence-guide--early-childhood-teachers.pdf?MOD=AJPERES&CVID=

Quennerstedt, A. (2016). Young children's enactments of human rights in early childhood education. *International Journal of Early Years Education, 24*(1), 5-18.

Ranson, M. (2012). Teaching strategies: The Convention on the Rights of the Child: Suggestions for educator action. *Childhood Education, 88*(6), 394-397.

Robson, J. (2016). Early years teachers and young children's rights: the need for critical dialogue. *Research in Teacher Education, 6*(1), 6-11.

Save the Children (2006). Retrieved from (17.04.2016). http://www.savethechildren.org/atf/cf/%7B9def2ebe10ae432c9bd0df91d2eba74a%7D/STC_Annual2006.pdf

Shumba, A. (2003). Children's rights in schools: What do teachers know? *Child Abuse Review*, *12*(4), 251-260.

Smith, A. B. (2017). Children's rights and early childhood education. In L. Miller, C. Cameron, C. Dalli, & N. Barbour (Eds.), *The SAGE Handbook of early childhood policy* (pp. 452-466), London: SAGE Publications

Strauss, A., & Corbin, J. (1990). *Basic of qualitative research: grounded theory procedures and techniques*. Newbury Park, CA: Sage.

Te One, S. J. M. (2008). *Perceptions of children's rights in three early childhood settings* (Unpublished doctoral thesis). Victoria University of Wellington, New Zealand.

Tozduman Yaralı, K., & Güngör Aytar, F. (2017). Investigate the participation rights of children into the preschool classes through teachers and children views. *Bartın University Journal of Faculty of Education, 6*(1), 29-47. DOI: 10.14686/buefad.263554

Trägårdh, J. (2009). *It is good! It always reminds us that they have rights and we have rights – A study about working with children's rights in a few preschools in South Africa.* Retrieved from http://bada.hb.se/bitstream/2320/4983/1/uppsats%21%21%20komp%20och%20klar%20f%5E%5Er%20ventilering%21%21.pdf

Turnšek, N. (2016). Teachers' implicit theories on child participation in preschool. *Athens Journal of Education, 3*(1), 7-18. Retrieved from http://pefprints.pef.uni-lj.si/3381/1/Turnsek_Teachers.pdf

Türkoğlu, D., & Gültekin Akduman, G. (2013). Üniversitelerin okul öncesi eğitim programları "çocuk hakları" dersi ve öğrenci görüşlerinin incelenmesi. *Uluslararası Aile Çocuk ve Eğitim Dergisi, 1*(2), 56-68

UN Committee on the Rights of the Child, General comment No. 7 (2005). *Implementing Child Rights in Early Childhood*. Retrieved from http://www.refworld.org/docid/460bc5a62.html

United Nations Children's Fund (UNICEF) (2014). *Child rights education toolkit: Rooting child rights in early childhood education, primary and secondary schools*. Retrieved from https://www.unicef.org/crc/files/UNICEF_CRE_Toolkit_FINAL_web_version170414.pdf

Journal of Theoretical Educational Science, 12(4), 1284-1305, October 2019
Kuramsal Eğitimbilim Dergisi, 12(4), 1284-1305, Ekim 2019
[Online]: https://dergipark.org.tr/akukeg
DOI number: http://dx.doi.org/10.30831/akukeg.478101

Mathematics Teachers' Use of Mathematical Descriptions, Explanations and Justifications While Teaching Function Concept: The Case of Samet

Matematik Öğretmenlerinin Matematiksel Tanımlamaları, Açıklamaları ve Doğrulamaları Kullanımı: Samet Örneği

Berna TATAROĞLU-TAŞDAN*

Received: 02 November 2018 **Research Article** **Accepted:** 07 February 2019

ABSTRACT: It is important for teachers to design and use mathematically accurate descriptions, explanations and justifications that are comprehensible and useful for students in the context of reflecting their mathematical knowledge for teaching. The purpose of this study is to examine a mathematics teacher's mathematical knowledge for teaching function concept by investigating his use of mathematical descriptions, explanations and justifications. The study was conducted as a descriptive case study. The participant in the study was one mathematics teacher (Samet) who volunteered to join the research. Data was collected via observing and recording the teacher's teaching of the function concept and survey of function concept. The results of the study revealed that the teacher mostly used mathematical descriptions in his teaching. This was followed by mathematical explanations, and mathematical justifications. The teacher's use of mathematical descriptions, explanations and justifications and his sufficiency at using these varied according to cases. Results indicated some deficiencies in the teacher's mathematical knowledge for teaching.

Keywords: mathematical knowledge for teaching, teaching function concept, mathematical descriptions, mathematical explanations, mathematical justifications.

ÖZ: Öğretmenlerin, öğretmek için matematik bilgilerini yansıtmaları bağlamında, öğrenciler için anlaşılır ve kullanışlı ve matematiksel olarak doğru tanımlamaları, açıklamaları ve doğrulamaları tasarlamaları ve kullanmaları önemlidir. Bu çalışmanın amacı, bir matematik öğretmeninin fonksiyon kavramının öğretiminde matematiksel tanımlamaları, açıklamaları ve doğrulamaları kullanımını araştırarak öğretmek için matematik bilgisini incelemektir. Çalışma, tanımlayıcı bir durum çalışması olarak gerçekleştirilmiştir. Araştırmanın katılımcısı araştırmaya katılmak için gönüllü olan bir matematik öğretmenidir (Samet). Veriler, öğretmenin fonksiyon kavramı öğretiminin gözlemlenmesi ve kaydedilmesi ve fonksiyon kavramı anketi ile toplanmıştır. Araştırmanın sonuçları, öğretmenin öğretiminde çoğunlukla matematiksel tanımlamaları kullandığını ortaya koymuştur. Bunu matematiksel açıklamalar ve matematiksel doğrulamalar takip etmiştir. Öğretmenin matematiksel tanımlamaları, açıklamaları ve doğrulamaları kullanımı ve bunları kullanmadaki yeterliliği farklı durumlara göre değişiklik göstermiştir. Sonuçlar, öğretmenin öğretmek için matematik bilgisindeki bazı eksiklikleri olduğunu göstermiştir.

Anahtar kelimeler: öğretmek için matematik bilgisi, fonksiyon kavramı öğretimi, matematiksel tanımlamalar, matematiksel açıklamalar, matematiksel doğrulamalar.

* *Corresponding Author*: Res. Asst. Dr, Dokuz Eylül University, İzmir, Turkey, berna.tataroglu@deu.edu.tr, https://orcid.org/0000-0002-5851-6144

Citation Information
Tataroğlu-Taşdan, B. (2019). Mathematics teachers' use of mathematical descriptions, explanations and justifications while teaching function concept: The case of Samet. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science]*, *12*(4), 1284-1305.

ISSN: 1308-1659

Introduction

It is known that the improvement of mathematics education for all students requires effective mathematics teaching in all classrooms (National Council of Teachers of Mathematics [NCTM], 2000). To achieve effective teaching, mathematics teachers need to have various knowledge and skills. Although teaching mathematics well is a complex endeavour, and there are no recipes for helping all students learn or for helping all teachers become effective (NCTM, 2000), research results help teachers and researchers to achieve this by presenting pedagogical models of teacher knowledge (An, Kulm, & Wu, 2004; Ball, Thames, & Phelps, 2008; Fennema & Franke, 1992; Grossman, 1990; Magnusson, Krajcik, & Borko, 1999; Shulman, 1986, 1987).

Pedagogical content knowledge (PCK), one of the most important conceptions of teacher knowledge, was first introduced by Shulman (1986, 1987). Shulman (1987) defined PCK as "the special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding" (p. 8). After Shulman (1986, 1987) proposed the notion of PCK, many researchers studying the field of teacher education used PCK for developing teacher knowledge models and frameworks. They re-conceptualized PCK by implementing it in various disciplines. Within the context of mathematics education, Deborah Ball and her colleagues studied how mathematics teachers carry out the work of teaching mathematics. Then Ball et al. (2008) stated that teaching for understanding requires special mathematical knowledge for teaching (MKT) and proposed the MKT model for effective mathematics teaching, building on the concept of PCK (Shulman, 1986, 1987). By MKT, they meant the mathematical knowledge needed to carry out the work of teaching mathematics. They also highlighted that their definition begins with teaching, not teachers (Ball et al., 2008). Ball et al. (2008) see teaching as everything that teachers must do to support the learning of their students. Similarly, Hill et al. (2008) stated that by MKT they mean not only the mathematical knowledge common to individuals working in diverse professions, but also the subject matter knowledge that supports that teaching, for example, why and how specific mathematical procedures work, how best to define a mathematical term for a particular grade level, and the types of errors students are likely to make with particular content.

When we look at the literature, we see that a group of researchers (Hill et al., 2008; Snider, 2016) that used MKT in their research have investigated the relationship between MKT's reflections on classroom practices (how the teachers implement MKT in teaching) and the quality of mathematics teaching. It should be noted that examining the quality of teachers' knowledge itself is only a step in examining the quality of mathematics teaching and learning that mathematics educators are striving to achieve (Ball & Bass, 2002). In their study, Hill et al. (2008) related teachers' mathematical knowledge to the quality of their classroom work and determined the dynamics of knowledge used in teaching by examining the relationship between teachers' MKT and the mathematical quality of their instruction. Then, the Learning Mathematics for Teaching [LMT] Project (2011) team that was consisted of Hill and her colleagues described the framework and instrument for measuring the mathematical quality of mathematics instruction in detail. They created a set of constructs and codes which capture key mathematical events in classrooms while describing the mathematical

quality of instruction. In another study, Hill (2010) examined elementary school teachers' mathematical knowledge for teaching and the relationship between such knowledge and teacher characteristics.

There are several other studies examining teachers' mathematical knowledge and mathematics instruction (Ball, 1990; Charalambous, 2010; Charalambous & Hill, 2012; Cohen, 1990; Heaton, 1992; Kersting, Givvin, Thompson, Santagata, & Stigler, 2012; Lloyd & Wilson, 1998; Snider, 2016; Steele & Rogers, 2012; Wilson, 1990). In these studies, one or more mathematics teachers' teaching practice were examined concentrating on different components like students learning, selecting and implementing mathematical tasks, applying mathematics in real-life situations, curriculum materials, providing proof and national educational policies. It is important in the studies that teacher knowledge and teaching practice are examined together. Although there are studies investigating which MKT components are used when the teacher uses descriptions, explanations and/or justifications in the class, it is possible to say that they are still limited. It is thought that increasing these researches may provide important results in terms of MKT especially in terms of teaching function concept. As Snider (2016) stated, there has been a need for investigating how teachers draw on knowledge when they enact teaching practices. The purpose of this study is to examine a mathematics teacher's teaching in terms of using mathematical descriptions, explanations and justifications to infer his MKT for function concept. In other words, by following the suggestions provided by existing teacher education literature, the aim of the research is to determine how one mathematics teacher (who represents a little sample of Turkish mathematics teachers) reflected his MKT while teaching the function concept. Even though the aim of the study is not to generalize about the teachers' knowledge and reflections of this knowledge, some inferences and implications could be obtained regarding Turkish mathematics teachers' situations. The research question is as follows:

- How does a mathematics teacher use mathematical descriptions, explanations and justifications while teaching the function concept?

Teaching Function Concept

Function is a fundamental concept of mathematics (NCTM, 2000). It is fundamental because it forms a basis for many other mathematical concepts like limit, derivative, integral. Accordingly, in Turkish mathematics curriculum, the function concept begins in grade 9 and continues throughout the high school. Besides, functions are essential in every field of applied mathematics such as statistics, computer programming, economy (Ronau, Meyer, Crites, & Dougherty, 2014). It is important to study how the teachers teach this concept and how the students learn it. In the literature, it seen that teaching function concept has been investigated by different researchers (Aksu & Kul, 2016; Even, 1993; Even & Tirosh, 1995; Hacıömeroğlu, 2006; Hatisaru & Erbaş, 2017; Karahasan, 2010; Llinares, 2000; Nyikahadzoyi, 2015; Steele, Hillen, & Smith, 2013; Stein, Baxter, & Leinhardt, 1990; Tataroğlu-Taşdan & Yiğit-Koyunkaya, 2017; Wilson, 1992). Some examined it with a general view to PCK, while others used the MKT framework. For example, Tataroğlu-Taşdan and Yiğit-Koyunkaya (2017) examined pre-service mathematics teachers' MKT in terms of function concept and the results of their study showed that pre-service mathematics teachers had limited

knowledge regarding teaching of function concept and they had difficulties to reflect their knowledge of function concept on their teaching. In their study, Hatisaru and Erbaş (2017) examined the potential interrelationships between teachers' MKT the function concept and their students' learning outcomes of this concept. They pointed that teachers' MKT and students' learning outcomes were related to a degree, but this relationship was not straightforward. They also concluded that the teachers' knowledge influenced the quality of their instructional practices, and the instructional practices played a mediating role in student learning. Steele, Hillen and Smith (2013) dealt with the prospective and practicing teachers' learning in a teaching. They found the participants showed growth in their ability to define function, to provide examples of functions and link them to the definition, in the connections they could make between function representations, and to consider the role of definition in mathematics and the K-12 classroom.

Mathematical Descriptions, Explanations and Justifications

One of the MKT components is teacher's knowledge of content and teaching (Ball et al., 2008). As a part of knowledge of content and teaching of function concept, secondary school teachers should know the different introductions for a particular topic, sequences of exercises, explanations, representations, definitions, and examples (Nyikahadzoyi, 2015). Hill et al. (2008) pointed out that teachers without mathematical knowledge cannot provide explanations, justifications, or make careful use of representations. So, each of these components are of importance for better teaching and learning of this concept.

Mathematical descriptions, explanations and justifications, three together or separately are considered in some studies (Hill et al., 2008; Lachner & Nückles, 2015; Snider, 2016; Xenofontos & Andrews, 2017). Hill et al. (2008) examined how MKT is associated with the mathematical quality of instruction. They studied a sample of ten teachers and collected their data via pencil-and-paper assessment of MKT, videotaped lessons and interviews. They analysed the data in terms of different components including mathematical descriptions, explanations and justifications. They found a significant, strong, and positive association between levels of MKT and the mathematical quality of instruction. They also found that there were many important factors that mediate this relationship, either supporting or hindering teachers' use of knowledge in practice. Xenofontos and Andrews (2017) suggested that explanations may be a useful tool for measuring prospective teachers' knowledge, in a study where they examined first-year undergraduate teacher education students' written explanations. Lachner and Nückles (2015) investigated the impact of instructors' different knowledge bases on the quality of their instructional explanations and found that deep content knowledge helped instructors generate explanations with high process-orientation. In her thesis, Snider (2016) investigated the impact of teachers' knowledge use in practice on selecting examples and explaining, which are two foundational practices in mathematics teaching. She found that different categories of explanations and teachers' knowledge use varied by explanation type.

Since the focus of this study is use of mathematical descriptions, explanations and justifications this section deals with these terms in detail. The codes created by Hill et al. (2008) were adopted in the study. Mathematical descriptions are defined as

providing clear characterizations of the steps of a mathematical procedure or a process (Hill et al., 2008). Descriptions tell only what the steps of a mathematical procedure or a process are. A mathematical description does not necessarily address the meaning or reason for these steps (Hill et al., 2008).

Explanations are practice that occur in classrooms and are shared between a teacher and their students (Snider, 2016). Ball and Bass (2002) indicate that mathematics teachers are frequently engaged in the work of mathematical explanations. They explain mathematics; they also judge the adequacy of the explanations in textbooks, given by their students, or in mathematics resource books for teachers (Ball & Bass, 2002). According to Leinhardt (2001) providing instructional explanations is a common way to support students' understanding. So, it is important to design mathematically accurate explanations that are comprehensible and useful for students (Ball & Bass, 2002). Mathematical explanations include giving mathematical meaning to ideas or procedures, namely by giving attention to the meaning of the steps or ideas, they don't necessarily provide mathematical justification (Hill et al., 2008).

Justification is a core mathematics practice (Staples, Bartlo, & Thanheiser, 2012). Mathematical justifications include deductive reasoning about why a procedure works or why something is true or valid in general (Hill et al., 2008). In studies, justification seems to be handled together with proof, argumentation or reasoning (Cai, 2003; Chazan, 1993; Staples et al., 2012; Yackel, 2001). This study is limited by the definition made by justification Hill et al (2008).

Mathematical descriptions, explanations and justifications were explained by several examples in Learning Mathematics for Teaching (LMT) Technical Report (2006). The first example is a subtraction.

$$\begin{array}{r} {\scriptstyle 5\ 13} \\ \not{6}\not{3} \\ -\ 28 \\ \hline 35 \end{array}$$

In the context of this example, mathematical description simply meant the recounting of the steps involved in subtraction with regrouping—cross out the 3, write 13, cross out the 6 and write 5. Subtract 8 from 13 to get 5… Mathematical explanations give mathematical meaning to ideas or procedures. In this example, the teacher (or student) might explain that the crossing-out process is really a way of re-writing the 63 as 50 and 13 ones. Re-writing in this way allows one to subtract the ones and tens column without using negative numbers. Finally, mathematical justification includes deductive reasoning about why a procedure works or why something is true or valid in general. Here, the teacher might help students determine whether this algorithm can be used to subtract any two multi-digit whole numbers where trading is required (LMT, 2006).

Method

This study was conducted as a descriptive case study. Case study research is suitable for answering questions that start with how, who and why; when the researcher has little control over events and when the focus is on a contemporary phenomenon (Yin, 2009). Creswell (2003) define case study as "researcher explores in depth a

program, an event, an activity, a process, or one or more individuals" (p. 15). In this study, it was aimed to examine a mathematics teacher's teaching in terms of using mathematical descriptions, explanations and justifications to infer his MKT for function concept, so case study was selected for research design.

Participant

The participant was one mathematics teacher who volunteered to join the research. He had 14 years of experience when the research was conducted. He was a teacher interested in new developments in mathematics teaching. He stated that he had participated in a seminar on mathematics teaching methods, a seminar on new approaches in mathematics and "Preparing the Guide to the Olympics of the Scientific and Technological Research Council of Turkey" (TÜBİTAK) activity. For this study, he was assigned the nickname Samet. Samet was working at a high school which accept the students with higher scores from national tests conducted by The Turkish Ministry of National Education relative to other schools. So, it can be said that the students in Samet's class were above a certain level of mathematical success. This difference of the school structure originated the reason for choosing this teacher as a case to examine using mathematical descriptions, explanations and justifications.

Data Collection

Data was collected via observing and recording Samet's teaching of the function concept and a survey of function concept which was filled out by Samet. Marshall and Rossman (1989) define observation as "the systematic description of events, behaviours, and artefacts in the social setting chosen for study" (p. 79). Observations enable the researcher to describe existing situations using the five senses, providing a "written photograph" of the situation under study (Erlandson, Harris, Skipper, & Allen, 1993). As mechanical recording devices usually give greater flexibility than observations done by hand (Smith, 1981), video recording was preferred in this study. Samet's teaching of the function concept was observed (via unstructured observation) for 5 lessons and recorded by a video camera. The video camera was placed behind the classroom. The researcher carried out the video recording and zoomed in on the board or the people when necessary. One digital audio recorder was also in the teacher's pocket, so that the audio recording could be referred to if there was a segment that could not be understood in the video recording. In these lessons, Samet tried to define and construct the function concept and the types of function.

In the survey of function concept, there were questions helping to determine a teacher's MKT in terms of function concept. The questions in the survey which were obtained from the literature included defining function or giving an alternative definition, giving examples for function concept, estimating the students' ideas by examining their answers to specific function questions and approaches to remove some misconceptions regarding function concept. Samet completed the survey in approximately 40 minutes in writing. Data collected via survey of function concept was used as secondary data to support the observations as well.

Data Analysis

At the beginning of the data analysis, video records were transcribed verbatim. Then the researcher read the full text and coded the transcribed lessons. The data were analysed according to the codes previously determined (Creswell, 2003). The codes called "*mathematical description, mathematical explanation and mathematical justification*" adapted from Hill et al. (2008), were used for data analysis. The descriptive analysis method was conducted as data analysis.

As the descriptive analysis required, the researcher identified the main codes in the data as described in Hill et al.'s (2008) study. The main codes were mathematical description, mathematical explanation and mathematical justification. Then sub-codes were obtained. In their study, Hill et al. (2008) separated the codes as self-produced or co-produced with students. Thus, they obtained sub-codes as "*elicits student description*" and "*elicits student explanation*" (LMT, 2011). Similarly, in this study, it was an important point to distinguish whether the teacher was doing the mathematical description, explanation and justification himself or if he wanted the students to do it. Therefore, the main sub-codes for three categories (mathematical description, mathematical explanation and mathematical justification) were emerged as "does himself" and "asks students".

Context was important in determining which data will be fetched under which code. Although the question words such as "why" and "how" that the teacher used seem like explanation or justification, looking at these words alone did not affect which code to decide. It was decided that if the teacher was waiting for explanation or justification with the why question or description was enough for him by looking at the context. The sufficiency of the teacher's actions was also seen significant in the analysis. Therefore, the sufficiency of the teacher's use of mathematical descriptions, mathematical explanations and mathematical justifications were sub-categorized as sufficient and insufficient. The context was considered while deciding the sufficiency of an action. Mathematical accuracy, students' questions or comments, teacher's deepening of students' thoughts were the indicators of sufficiency.

Only mathematical explanations included a different sub-code, called 'needed but absent'. This sub-code was used for the cases which suitable conditions exist for making mathematical explanations and doing it would help students to learn but the teacher did not. Sample rows taken from the data analysis are provided in Table 1.

Table 1

A Section from Data Analysis

Transcription section		Teacher's Action	Sufficiency
Samet	First one is a function. Işıl, why is it a function?	Ask a student for mathematical explanation	
Student	Because all element in set A		Insufficient (It is understood that the student could not explain her thoughts, however the teacher did not encourage her to do)
Samet	All the elements in A have an element in B that matches. Is there a non-matched element in the definition set?	Does a mathematical explanation himself	Insufficient (He pointed on only one of the conditions of being a function, not to the other. For this reason, the explanation is insufficient.)
Stud. (together)	No.		
Samet	Not. So, relation f1 is a function from A to B.		

To ensure validity and reliability, a second coding was realized by the (same) researcher nearly two months after the first coding, in accordance with the stability method (Krippendorff, 1980; Weber, 1985) and a percent agreement (Miles & Huberman, 1994) of greater than 70% was achieved between two coding. In addition, a second coder who is an expert mathematics educator coded a part of the data and the percent agreement was calculated as 87%. Then the researcher and the expert came together to resolve coding discrepancies and discussed the issues until an agreement was reached.

Direct quotations were also given to increase the reliability of the research. They were utilized to support the interpretations in the tables. While interpreting the actions of Samet, it was adequate to give only quotations from Samet. However, interpreting the cases where Samet asked students to explain required quotations of dialogues to reflect classroom environment in detail. In the dialogues, the source of expression (teacher, student) and the expressions have been included. The situations where students talked as a crowded group have been indicated as Stud. (together). Explanations have been included (within the expressions) in square brackets and in italics to describe the current situation of the class. "…" in the dialogue means there were other conversations that were skipped.

Data obtained via survey of function concept was also analysed by using descriptive analysis. In the analysis of the survey, MKT components were considered. The findings were served as secondary ones and used to support primary findings obtained from observations. Therefore, triangulation could be used to ensure the validity of data.

Findings

This section will first present the general findings regarding to the examination of Samet's teaching of the function concept in terms of using mathematical descriptions, explanations and justifications. Then they will be presented separately in detail. Table 2 presents a general picture of Samet's teaching of the function concept according to use of mathematical descriptions, explanations and justifications.

Table 2

Use of Mathematical Descriptions, Explanations and Justifications in Samet's Teaching

Teacher's Action	Sufficiency	Number of cases for using mathematical descriptions	Number of cases for using mathematical explanations	Number of cases for using mathematical justifications
Does himself	Sufficient	54	4	-
	Insufficient	1	2	-
	Needed but Absent	-	4	-
Asks students	(student's response) Sufficient	9	1	-
	(student's response) Insufficient	5	14	1
Total		69	25	1

Table 2 shows that Samet mostly (in 69 cases) used mathematical descriptions, sometimes (in 25 cases) conducted mathematical explanations and only once (in one case) applied mathematical justification in his teaching of the function concept. Samet usually gave mathematical descriptions by himself and he was sufficient while doing this. When he wanted the students to give descriptions, the students often did it sufficiently, though sometimes they could not. In the case of mathematical explanations, Samet often asked the students to do it and sometimes did it himself. However, the students were insufficient in making mathematical explanations in almost all cases. It was also a remarkable finding that only one case of mathematical justification exists, where a student was asked to provide the justification and was insufficient in doing so.

Findings Related to Mathematical Descriptions

The findings about the examination of Samet's teaching in the line with mathematical descriptions are given via Table 3 in more detail. For presenting findings, a six-column table was used. In the table, the first column indicated the teacher's actions, the second column summarized the sufficiency of the action, the third column showed to which lesson the findings belonged, the fourth column contained the frequency of the action, the fifth column listed the teacher's statement and the sixth

column contained the author's interpretation of what the mathematical description/explanation/justification was. Sub-codes were placed in the rows. Teacher actions were divided into two rows; the first was what he was doing himself, the second showed what he asked the students to do. This distinction was determined depending on who will do it.

Table 3

Use of Mathematical Descriptions in Samet's Teaching

Teacher's Action	Sufficiency	*L*	*n*	A Sample Statement	Mathematical description
Does himself	Sufficient	L1	18	*Then let's define such a relation, let's define a beta relation, consisting of ordered pairs of x and y.*	A relation is made up of ordered pairs.
		L2	10	*Now what is the function? It is the special form of the relation, there is a domain set, range set and image set, right?*	Function is the special form of the relation.
		L3	8	*In the rule of function, e.g. f(1), what did we do? In other words, we were replacing 1 in the rule of function to find the matched element.*	We must write that element at the time we see x in the function to find the image under the function f.
		L4	8	*When a graph of a function is given, we plot parallel lines parallel to the x-axis to see if the function is one to one.*	Description for horizontal test
		L5	10	*The function f(x) will only have x, the coefficient of x will have no value other than 1. So, what if we want this function to be a unit function? f(x) = x.*	The unit function must be in the form f(x) = x.
	Insufficient	L1	1	*If the root degree is double, the absolute value cannot be a negative value. Either zero or a positive value. Why is this said? To specify a real number ...*	If the root degree of an absolute value expression is even, inside of the root must always be positive or zero.
	Needed but Absent	--	--		
Asks students to do	(student's response) Sufficient	L3	3	*What we have said is that if a function is different in certain subranges of the domain set, what do we call it?*	Desired description for piecewise function
		L4	2	*It is not a one to one function, why not? Seda, why not?*	Desired description for one-to-one function

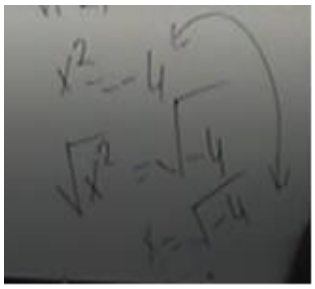
		L5	4	*Will the term x be in the constant function?*	Desired description for constant function
	(student's response) Insufficient	L3	1	*What were we doing in this relation? If we say A to B, then on which axis do we write set A, Berke?*	Desired description for graph of the relation
		L4	1	*Why is the function not one to one?*	Desired description for being a one-to-one function
		L5	3	*Aykut, how is a function a unit function?*	Desired description for unit function

L: Lesson, n: number of cases

If we look at the findings related to the mathematical descriptions that Samet used in his teaching in more detail, it is evident that Samet usually used mathematical descriptions by himself in each lesson and he was sufficient while doing this. For example, Samet made a mathematical description sufficiently for mathematical relations by using the statement "*Then let's define such a relation, let's define a beta relation, consisting of ordered pairs of x and y,"* in his first lesson. By this sentence he pointed out that a relation is made up of ordered pairs. In the second lesson, he introduced the function concept through the mathematical relation and emphasized that the function is the special form of the relation.

Samet was insufficient in making mathematical descriptions in one case. In this case, the students were confused and had some questions about if x^2 could be equal to -4 or not. Samet tried to give descriptions in response to these questions by highlighting that if the root degree of an absolute value expression is even, the inside of the root must always be positive or zero. He tried to give this description by the method of finding a contradiction. A screen shot of the board and Samet's statements related to this moment are given in Figure 1.

Figure 1. A screen shot of the board and Samet's statements



Let's go wrong. Let's assume that this is true [writing $x^2=-4$], say something like this. Can I take the root of each side? Ok I took. One more thing, we are making another mistake, we say that when we speak absolute value, if there is no information about x, how do we normally remove the double powers? Absolute x. Let's say we made one more mistake on it, a student mistake, we missed it, we took it out as x. You said it is not true ($x^2=-4$) at the beginning, but now you say it is $x=\sqrt{-4}$). Isn't there a contradiction? Right? So, what does that mean? If there is no number whose square is negative, when the root degree is double, the absolute value cannot be a negative value. It must be either zero or a positive value.

It was understood from the students' comments and questions that Samet's descriptions were not enough to overcome the confusion of the students. Some of the

students stated that they didn't understand. Then, Samet repeated the same sentences for making clearer the mathematical description. It may be related to the teacher's MKT and in particular his knowledge of content and teaching. A similar one to this finding was obtained from the survey of function concept. First, Samet was asked for the definition of the function, and then he was asked for a new definition to give a student who did not understand the first definition. Samet gave Dirichlet-Bourbaki definition first. However, he was not very successful in this regard when he was asked to make a new definition for the student who did not understand. Because he only gave an example of a relation. He said "*Let the relation has a specific rule. It matches each element of A to its square. In this case, pair as (x, x^2) exists (x^2 is in B set). The relation of these pairs is called a function from A to B.*". It can be said that this definition or example given for a student who does not understand the first definition is not enough. These two supporting findings show that there are some shortcomings in Samet's MKT.

Occasionally, Samet asked his students to make descriptions. The students' responses were sometimes sufficient and sometimes not. When Samet asked a student to make a mathematical description and the student could not make it at once, he continued his teaching and ignored the effort of the student. Instead, he could have helped or encouraged the student to make his/her description in detail. In his fifth lesson, the below dialogue was conducted:

Samet: What did we call the unit function? So anyhow, a function is a unit function. Aykut? Any function is a unit function. It is called a unit function.

Aykut: f(x) will be equal to x, then the value that is given as x will be equal to x.

Samet: Friends, did I not tell you here is the unit function?

Aykut: Yes.

Samet: Now I will ask something for the unit function. For example, if we define a function $f(x)=x^2$, would this unit be a function?

As seen in the dialogue, Samet asked a student (Aykut) a question and wanted a description of the unit function. Aykut actually gave the right answer. However, Samet did not support Aykut's answer, and he continued to play an active role in his teaching. This suggests that it is a formality for the teacher to ask the student questions. When the teacher does not care about the answers from the students, the students may think that their thoughts are not significant for the teacher, so they may not give answer next.

Findings Related to Mathematical Explanations

Findings about the examination of Samet's teaching when giving mathematical explanations are given via Table 4 in detail.

Table 4

Use of Mathematical Explanations in Samet's Teaching

Teacher's Action	Sufficiency	*L*	*n*	A Sample Statement	Mathematical explanation
Does himself	Sufficient	L1	4	*What we are looking for here is that an element in the domain set must be matched to an element in the set B, that is, in the value set. Ok? This is not a function. You can think of 2a, 2b, 2c. Can you be both in this class and in other class at the same time?*	Explanation of the conditions of being a function
	Insufficient	L1	2	*So, there is the rule of function. According to the rule, we are doing this matching. We do not do it randomly, okay?*	Explanation of "each function must have a rule".
	Needed but Absent	L1	4	*Someone may be a mother of 5 children. But is it possible that a child has 5 mothers?*	Explanation of the conditions of being a function through a daily life example
Asks students to do	(student's response) Sufficient	L1	1	*f2 is not a function. Why not?*	Desired explanation of the conditions of being a function
	(student's response) Insufficient	L1	3	*What happened this time to our elements? From Seyma to the mother [matches the element in children set to the set of mothers with arrows]. Ok? Is there a difference here, between beta and the inverse of beta?*	Desired explanation on relation and its inverse.
		L2	8	*Derman, is it a function or not?... You don't think so, why?*	Desired explanation of the conditions of being a function
		L3	1	*Why does every element have to be used?*	Desired explanation of the conditions of being a function
		L4	2	*ax plus b is divided by cx plus d. We say the functions in this format are a constant function.* *Yes, this is memorized knowledge. I'm passing over it. What do you mean by constant? So, what would you know if one of you calls it a constant function?*	Desired explanation of constant function

L: Lesson, n: number of cases

Table 4 shows that Samet sometimes made mathematical explanations in his teaching by himself. However, he often asked students to do it. Most often, he made explanations about the conditions of being a function. It may be appropriate to use mathematical explanations frequently in teaching a new concept. In the teaching of the concept of function, especially at the entrance of the subject, he utilized daily life examples. He gave an example of matching "children to mothers" and tried to construct the function concept on this example. Therefore, Samet could explain the concept of function and the conditions of being a function with daily life examples. While making explanations, he was mostly sufficient. For example, he explained that an element of the domain set cannot be matched with more than one element in the value set if this correspondence is a function by these words: "*This is not a function because you can think of 2a, 2b, 2c. Can you be both in this class and in other class at the same time?*". In addition, he supported his explanation by a daily life example as already mentioned. Here, the daily life example was an analogy that represents students in a class as elements in a set.

In making some of the explanations, Samet was insufficient. For example, he explained that every function must strictly have a rule by saying "*So there is a rule of function. According to the rule, we are doing this matching. We do not do it randomly, okay?*". It can be said that Samet's explanation does not coincide with the arbitrariness of a function. The arbitrary nature of functions indicates that functions do not have to be described by any specific expression, follow some regularity, or be described by a graph with any particular shape (Even, 1990). Similarly, Samet mentioned in the survey of function concept that the function is a matching according to a certain rule. This finding showed Samet's inadequate knowledge of specialized content knowledge within the MKT.

In Samet's teaching, there were some cases of needed but absent in the context of mathematical explanations. These were the cases where a mathematical explanation was needed but Samet did not make it. One of these cases was an expected explanation of the conditions of being a function using daily life examples. In that case, Samet tried to construct the concept of function by using the inverse of the relation. He tried to find out from the students the reverse of the mothers-children correspondence that he gave in the beginning of the lesson. This situation caused confusion in the students' minds who were trying to construct the function concept. Therefore, it seems that it would have been appropriate for Samet to give an explanation at that time. However, Samet only said "Someone m*ay be a mother of 5 children. But is it possible that a child has 5 mothers?".* The teacher passed this part very quickly without being sure that the students understood it. That was not enough to get rid of the students' confusion. Anyway, the comments and questions from the students were an indication of the fact that the concept has not yet been clearly created in their minds. It was also unclear why Samet chose to use the inverse of the relation. He tried to determine the conditions of being a function by examining the inverse together with the relation itself. But this route that he chose was a little complicated for his students.

Another case was regarding an attempt for moving from the daily life example of the function concept to the algebraic form of it. Samet's expression was as follows: "*We told it (referring to the example of children and their mothers) right away, but we're not talking about it here, okay? So, now let's write a few examples and determine*

if they are functions. Let's say whether the following relations are functions [repeats]. For example, from f Z to Z, (x + 1)/2, let's show it with f. Let f(x)=(x+1)/2 be this."

In teaching the function concept, Samet gave the example of children and their mothers first, and then he gave random correspondences between two sets via a Venn diagram. He proceeded with the lesson by using the rule $f(x)=x^2$ as a mathematical example. After giving this example, he asked if the relations given by different algebraic rules represent a function or not. However, it is understood from the students' questions that the concept of function was not clear to the students. In this case, which requires an effective mathematical explanation, the explanation by Samet was not enough. His expression was not even evaluated as a mathematical explanation. It is thought that Samet's attempt to construct the concept of function by using the inverse of the relation had a negative effect on students' learning at the beginning of the lesson, as stated in the previous paragraph, and this confusion continued for a while.

On the other hand, Samet often asked his students to make explanations during his teaching. It was a good attempt to engage students in the teaching process by asking them to make mathematical explanations. However, the students were insufficient in making mathematical explanations in almost all cases (14 of 15 cases). There was only one case where a student made a sufficient mathematical explanation at Samet's request. In this case, Samet asked student to explain why the relation is not a function and the student explained it sufficiently.

As already mentioned, the students were mostly insufficient in making mathematical explanations. Here is an example of these cases:

Samet: What happened this time to our elements? From Seyma to the mother [*matches the element in children set to the set of mothers with arrows*]. Ok? Is there a difference here, between beta and the inverse of beta?

Students: We changed the locations of x and y ...

Samet: Okay, we changed places within the ordered pair. We changed places of x and y within the ordered pair as we write the reverse of a relation. Is that the only difference? Something else?

In the first lesson, Samet examined the differences between the relation and its inverse and asked students to state it. Although the students gave the correct answer, he passed over it quickly and tried to reach the place he had in mind. Another dialogue regarding a similar case is presented:

Samet: First, write the pairs of the function f, the list of elements. Then where do you show us these elements? Show it in the analytical plane; So, draw your graph.

Student: Ok. Every element from A to B must be used. So…

Samet: Why does every element have to be used?

Student: Because it is a function.

Samet: Ha, that it is, there will not be any unmatched elements in the domain set.

As seen in the dialogue in his third lesson, Samet asked a student to write the function by the list method and then to draw its graph on the board. He used the question "why?" to ask the student to explain the conditions of being a function. Like the previous case, he explained the student's response himself instead of giving an opportunity to the student.

Findings Related to Mathematical Justifications

Findings about the examination of Samet's teaching where he used mathematical justifications are given via Table 5 in detail.

Table 5

Use of Mathematical Justifications in Samet's Teaching

Teacher's Action	Sufficiency	*L*	*n*	A Sample Statement	Mathematical justification
Does himself	Sufficient	--	--		
	Insufficient	--	--		
	Needed but Absent	--	--		
Asks students to do	(student's response) Sufficient	--	--		
	(student's response) Insufficient	L1	1	*So, what will the function be? A relation that matches the elements in A to the elements in B, but what kind of relation? A special relation, then can we say that every relation is a function?*	Every relation is not a function, but every function is a relation.

L: Lesson, n: number of cases

There was only one case of mathematical justification in Samet's teaching of the function concept. In this case, he asked the students to justify if a function is always a relation or a relation is always a function.

Samet: So, what will the function be? A relation that matches the elements in A to the elements in B, but what kind of relation? A special relation, then can we say that every relation is a function?

Stu. (together): No.

Stu. (together): Each function is a relation.

Samet: Each function is a relation. Let's repeat that a function is a relation.

As seen in the dialogue, although Samet asked the students to make a mathematical justification, he didn't allow students to do it. He interfered with their answers and passed on quickly. So, the sentence that "*Each function is a relation*" remained as something for the students to memorize. The students didn't think about or reason through it. Even though it was a very suitable environment for justification, Samet did not use the opportunity well.

Discussion and Conclusion

This study examined a mathematics teacher's teaching function concept in terms of using mathematical descriptions, explanations and justifications to infer his MKT. When Samet's teaching of the function concept was examined in the context of these components as Hill et al. (2008) categorized, mathematical descriptions were seen the

most frequently. This was followed by mathematical explanations, and mathematical justifications were the least seen. Similar to this study's result, Snider (2016) found that teachers' explanations containing superficial reasoning were most common, followed by procedural explanations, mathematical reasoning and finally, problematic explanations.

If we take a closer look at the results of the research, in addition to making mathematical descriptions and explanations by himself, Samet also frequently asked students to make descriptions and explanations. As Leinhardt (2010) stressed, it was appropriate for Samet to include questions like how and why, but Samet did not support the students or encourage them in explaining their answers briefly. It was enough for Samet to get answers from the students to his questions, and he had no intention of learning their underlying thoughts. However, it is an important pedagogical strategy to encourage elaboration of students' responses (Fraivillig, Murphy, & Fuson, 1999). Ball et al. (2008) also pointed to knowledge of content and students as a knowledge domain of MKT. They determined that teachers must be able to hear and interpret students' emerging and incomplete thinking, as expressed in the ways that pupils use language (Ball et al., 2008). NCTM (2000) also supports this claim by emphasizing that effective teaching involves observing students and listening carefully to their ideas and explanations. Moving from the obtained result, it can be said that Samet had some limitations in the frame of knowledge of students.

In some instances, Samet did not make any mathematical explanations although it was necessary. It has been observed that the academic excellence of the students led a quick approach in Samet's teaching. Although Samet attempted to include students in the learning-teaching process, he followed a teacher-centered and traditional teaching approach. Samet's school was at a good level in terms of student achievement. As explained in the "Participant" section, students in Samet's school had higher scores from national tests for entering this school. Therefore, this profile of the school may be an important factor at the result. In the dialogues provided in the above sections, it is seen that Samet received quick and accurate answers from the students to the most of the questions. This rapid progress also created a lack of time devoted to explanations or justifications. There was only one case of justification in Samet's teaching process, but he did not catch the chance to engage students in extended reasoning. Making a description and moving quickly was more suited to Samet's teaching approach. Samet often considered student responses similar to his own explanation he had in mind. This was similar to Ms. Hanes, a teacher who participated in Forman, McCormick and Donato's (1997) research. In addition, the adoption of a different approach for constructing the function concept (constructing the function concept by exploiting the relation and the inverse of relation) made Samet a little distressed. Because this approach confused the students' minds.

Developing sound explanations that justify the steps of the algorithm, and explaining their meaning, involves knowing much more about the algorithm than simply being able to perform it (Ball & Bass, 2002). For this reason, it is important to examine the teacher's knowledge when examining the use of descriptions, explanations and justifications. In this study, a mathematics teacher's (Samet's) knowledge (in the context of MKT) tried to be examined and the results of the study gave the idea that he had some limited knowledge of content and students and he reflected this in his teaching. Similarly, Tataroğlu-Taşdan and Yiğit-Koyunkaya (2017) found that pre-

service mathematics teachers had limited knowledge regarding teaching of function concept and they had difficulties to reflect their knowledge of function concept on their teaching. Furthermore, some deficiencies in knowledge of content and teaching may also have caused insufficient use of descriptions, explanations and justifications. Snider (2016) emphasizes that a good explanation requires more than common content knowledge, because learners are unlikely to understand a mathematical idea in its fully compressed final form. Few findings gave the idea of Samet's deficiencies in the specialized content knowledge, but it is also worth for further examining. The results of Hill et al. (2008) support this argument about Samet's MKT. They found that teachers with stronger MKT responded more appropriately to students and chose examples that helped students construct meaning of the targeted concepts and processes; teachers with weaker MKT were not successful at selecting and sequencing examples, presenting and elaborating upon textbook definitions, and using representations (Charalambous, 2010).

This study focused on a mathematics teacher's teaching of the function concept and tried to contribute the literature on mathematics teachers' MKT in terms of using mathematical descriptions, explanations and justifications. Unlike Hill et al. (2008), the codes were not converted into points, with a rubric to measure the mathematical quality of instruction. This study attempted to conduct an in-depth analysis of one mathematics teacher's use of mathematical descriptions, explanations and justifications for a deeper understanding of his teaching the function concept. The results obtained from this teacher's teaching suggest that mathematics teachers in Turkey might have deficiencies related to their MKT and they might have difficulty in reflecting their existing knowledge to their teaching. In this context, it is suggested that teachers should be supported with professional development programs in order to develop their knowledge and to use this knowledge in practice. The findings provided some suggestions for future studies. Further research could extend the study by including more teachers and investigating the teaching of other mathematical concepts. Multidimensional analysis of data which is collected from different samples using different tools could give different results regarding teachers' MKT. In addition, researchers could study with teachers who have different backgrounds (different years of experience or involved/not involved in professional development programs) and they could examine the effects of these variables on teachers' knowledge and practice.

References

Aksu, Z., & Kul, Ü. (2016). Exploring mathematics teachers' pedagogical content knowledge in the context of knowledge of students. *Journal of Education and Practice, 7(30),* 35-42.

An, S., Kulm, G., & Wu, Z. (2004). The pedagogical content knowledge of middle school mathematics teachers in China and the U.S. *Journal of Mathematics Teacher Education, 7*(2), 145-172.

Ball, D. L. (1990). Reflections and deflections of policy: The case of Carol Turner. *Educational Evaluation and Policy Analysis*, *12*(3), 247-259.

Ball, D. L., & Bass, H. (2002). Toward a practice-based theory of mathematical knowledge for teaching. In *Proceedings of the 2002 Annual Meeting of the Canadian Mathematics Education Study Group* (pp. 3-14).

Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special*? Journal of Teacher Education*, *59*(5), 389- 407.

Cai, J. (2003). Singaporean students' mathematical thinking in problem solving and problem posing: an exploratory study. *International Journal of Mathematical Education in Science and Technology*, *34*(5), 719-737.

Charalambous, C. Y. (2010). Mathematical knowledge for teaching and task unfolding: An exploratory study. *The Elementary School Journal*, *110*(3), 247-278.

Charalambous, C. Y., & Hill, H. C. (2012). Teacher knowledge, curriculum materials, and quality of instruction: Unpacking a complex relationship. *Journal of Curriculum Studies*, *44*(4), 443-466.

Chazan, D. (1993). High school geometry students' justification for their views of empirical evidence and mathematical proof. *Educational Studies in Mathematics, 24*(4), 359-387.

Cohen, D. K. (1990). A revolution in one classroom: The case of Mrs. Oublier. *Educational Evaluation and Policy Analysis, 12*(3), 311-329.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed method approaches*. Second Edition. Thousand Oaks, CA: Sage Publications.

Erlandson, D. A., Harris, E. L., Skipper, B. L., & Allen, S. D. (1993). *Doing naturalistic inquiry: A guide to methods*. Newbury Park, CA: Sage Publications.

Even, R. (1990). Subject matter knowledge for teaching and the case of functions. *Educational Studies in Mathematics*, *21*(6), 521-544.

Even, R. (1993). Subject-matter knowledge and pedagogical content knowledge: Prospective secondary teachers and the function concept. *Journal for research in mathematics education, 24*(2), 94-116.

Even, R., & Tirosh, D. (1995). Subject-matter knowledge and knowledge about students as sources of teacher presentations of the subject-matter. *Educational studies in mathematics*, *29*(1), 1-20.

Fennema, E., & Franke, M. (1992). Teachers' knowledge and its impact. In D. Grouws (Ed.), *Handbook of Research on Mathematical Teaching and Learning* (pp. 575-596). New York: Macmillan.

Forman, E. A., McCormick, D. E., & Donato, R. (1997). Learning what counts as a mathematical explanation. *Linguistics and Education*, *9*(4), 313-339.

Fraivillig, J. L., Murphy, L. A., & Fuson, K. C. (1999). Advancing children's mathematical thinking in everyday mathematics classrooms. *Journal for Research in Mathematics Education*, *30*(2), 148-170.

Grossman, P. L. (1990). *The making of a teacher: Teacher knowledge and teacher education.* New York: Teachers College Press.

Haciomeroglu, G. (2006). *Prospective secondary teachers' subject matter knowledge and pedagogical content knowledge of the concept of function* (Unpublished Doctoral Dissertation). Florida State University, Tallahassee, FL.

Hatisaru, V., & Erbas, A. K. (2017). Mathematical knowledge for teaching the function concept and student learning outcomes. *International Journal of Science and Mathematics Education*, *15*(4), 703-722.

Heaton, R. M. (1992). Who is minding the mathematics content? A case study of a fifth-grade teacher. *The Elementary School Journal*, *93*(2), 153-162.

Hill, H. C. (2010). The nature and predictors of elementary teachers' mathematical knowledge for teaching. *Journal for Research in Mathematics Education, 41(5),* 513-545.

Hill, H. C., Blunk, M. L., Charalambous, C. Y., Lewis, J. M., Phelps, G. C., Sleep, L., & Ball, D. L. (2008). Mathematical knowledge for teaching and the mathematical quality of instruction: An exploratory study. *Cognition and Instruction*, *26*(4), 430-511.

Karahasan, B. (2010). *Preservice secondary mathematics teachers" pedagogical content knowledge of composite and inverse function* (Unpublished doctoral dissertation). Middle East Technical University, Ankara, Turkey.

Kersting, N. B., Givvin, K. B., Thompson, B. J., Santagata, R., & Stigler, J. W. (2012). Measuring usable knowledge: Teachers' analyses of mathematics classroom videos predict teaching quality and student learning. *American Educational Research Journal*, *49*(3), 568-589.

Krippendorff, K. (1980). *Content Analysis: An introduction to its methodology*. Beverly Hills, CA: Sage Publications.

Lachner, A., & Nückles, M. (2016). Tell me why! Content knowledge predicts process-orientation of math researchers' and math teachers' explanations. *Instructional Science*, *44*(3), 221-242.

Learning Mathematics for Teaching (2006). *A Coding rubric for Measuring the Quality of Mathematics in Instruction* (Technical Report LMT1.06*)*. Ann Arbor, MI: University of Michigan, School of Education.

Learning Mathematics for Teaching Project (2011). Measuring the mathematical quality of instruction. *Journal of Mathematics Teacher Education*, *14*(1), 25-47.

Leinhardt, G. (2001). Instructional explanations: A commonplace for teaching and location of contrast. In V. Richardson (Eds.), *Handbook of research on teaching* [Fourth Edition]. Washington, DC: American Educational Research Association.

Leinhardt, G. (2010). Introduction: Explaining instructional explanations. In M. K. Stein, & L. Kucan (Eds.), *Instructional explanations in the discipline* (pp.1-5). New York: Springer.

Llinares, S. (2000). Secondary School Mathematics Teacher's Professional Knowledge: A case from the teaching of the concept of function, *Teachers and Teaching*, *6*(1), 41-62, DOI: 10.1080/135406000114744

Lloyd, G. M., & Wilson, M. R. (1998). Supporting innovation: The impact of a teacher's conceptions of functions on his implementation of a reform curriculum. *Journal for Research in Mathematics Education, 29*(3), 248-274.

Magnusson, S., Krajcik, J., & Borko, H. (1999). Nature, sources and development of pedagogical content knowledge for science teaching. In J. Gess Newsome and N.G. Lederman (Eds.), *Examining pedagogical content knowledge.* (95–132). Dordrecht, The Netherlands: Kluwer Academic Publishers.

Marshall, C., & Rossman, G. B. (1999). *Designing qualitative research* (3rd ed.). Thousand Oaks, CA: Sage.

Miles, M. B., & Huberman, M. A. (1994). *Qualitative analysis: An expanded sourcebook.* Thousand Oaks, CA: Sage.

National Council of Teachers of Mathematics (2000). Principles and standards for school mathematics. Reston, VA: NCTM.

Nyikahadzoyi, M. (2015). Teachers' knowledge of the concept of a function: A theoretical framework. *International Journal of Science & Mathematics Education*, *13*(2), 261-283.

Ronau, R. N., Meyer, D., Crites, T., & Dougherty, B. J. (2014). *Putting essential understanding of functions into practice in grades 9–12.* Reston, VA: National Council of Teachers of Mathematics.

Shulman, L. S. (1986). Those who understand; knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review,* 57(1), 1-22.

Smith, H. W. (1981). *Strategies of social research: The methodological imagination*, 2nd Edition, Englewood Cliffs, NJ: Prentice-Hall.

Snider, R. B. (2016). *How mathematical knowledge for teaching intersects with teaching practices: the knowledge and reasoning entailed in selecting examples and giving explanations in secondary mathematics* (Unpublished doctoral dissertation). United States of America: University of Michigan.

Staples, M. E., Bartlo, J., & Thanheiser, E. (2012). Justification as a teaching and learning practice: Its (potential) multifaceted role in middle grades mathematics classrooms. *The Journal of Mathematical Behavior*, *31*(4), 447-462.

Steele, M. D., & Rogers, K. C. (2012). Relationships between mathematical knowledge for teaching and teaching practice: the case of proof. *Journal of Mathematics Teacher Education*, *15*(2), 159-180.

Steele, M. D., Hillen, A. F., & Smith, M. S. (2013). Developing mathematical knowledge for teaching in a methods course: the case of function. *Journal of Mathematics Teacher Education, 16*(6), 451-482.

Stein, M. K., Baxter, J. A., & Leinhardt, G. (1990). Subject-matter knowledge and elementary instruction: A case from functions and graphing. *American Educational Research Journal, 27*(4), 639-663.

Tataroğlu-Taşdan, B., & Yiğit-Koyunkaya, M. (2017). Examination of pre-service mathematics teachers' knowledge of teaching function concept. *Acta Didactica Napocensia, 10*(3), 1-18.

Weber, R. P. (1985). *Basic content analysis, quantitative applications in the social sciences*. Beverly Hills, CA: Sage Publications.

Wilson, S. M. (1990). A conflict of interests: The case of Mark Black. *Educational Evaluation and Policy Analysis, 12*(3), 293-310.

Wilson, M. R. (1992). *A study of three preservice secondary mathematics teachers' knowledge and beliefs about functions* (Unpublished doctoral dissertation). University of Georgia, Athens, GA.

Xenofontos, C., & Andrews, P. (2017). Explanations as tools for evaluating content knowledge for teaching: A cross-national pilot study in Cyprus and Greece. In Dooley, T. & Gueudet, G. (Eds.), *Proceedings of the Tenth Congress of the European Society for Research in Mathematics Education* (CERME10, February 1 – 5, 2017). Dublin, Ireland: DCU Institute of Education & CERME.

Yackel, E. (2001). Explanation, justification and argumentation in mathematics classrooms. In M. v. d. Heuvel-Panhuizen (Ed.), *Proceedings of the 25th conference of the International Group for the Psychology of Mathematics Education* Vol. 1 (pp. 9 - 24). Utrecht, The Netherlands: PME.

Yin, R. (2009). *Case study research: Design and methods* (Fourth edition). Thousand Oaks, CA: Sage Publications.

Journal of Theoretical Educational Science, 12(4), 1306-1323, October 2019
Kuramsal Eğitimbilim Dergisi, 12(4), 1306-1323, Ekim 2019
[Online]: https://dergipark.org.tr/akukeg
DOI number: http://dx.doi.org/10.30831/akukeg.480171

Turkish Adaptation of Parental Reactions to Children's Positive Emotions Scale: A Validity and Reliability Study

Anne Babaların Çocukların Olumlu Duygularına Yönelik Tepkileri Ölçeği'nin Türkçe Uyarlaması: Geçerlik ve Güvenirlik Çalışması

Şükran KILIÇ* **Hatice KUMANDAŞ-ÖZTÜRK****

Received: 07 November 2018 **Research Article** **Accepted:** 17 June 2019

ABSTRACT: The aim of the study, which investigates psychometric characteristics of parental reactions to children's positive emotions scale (PRCPS) for Turkish parents. The study included 295 mothers and 295 fathers who have children aged 4-12 from Aksaray city center. ABÇODT is a 7-point Likert-type scale consisting of 12 scenarios. The translation and back translation process was conducted for the Turkish adaptation of the scale. Expert opinions were obtained for scope, semantic and conceptual equivalence. Confirmatory Factor Analysis (CFA) was used to assess the reliability of the scale and to examine the construct validity Results of CFA clarified that the scale has a four factor structure (socialization, encouragement, discomfort, reprimand) Inner consistency coefficients and test-retest values proved that PRCPS is a reliable measurement tool. The scale can be used both in evaluating how parents react to their children's positive emotions and in research dealing with developmental and family studies. It has also been proposed to use the scale in educational research to examine the reflection of parents' reactions to positive emotions of children in the school and classroom environment.

Keywords: parental emotional reactions, children's positive emotions, validity, reliability.

ÖZ: Bu çalışmanın amacı anne babaların çocukların olumlu duygularına yönelik tepkileri ölçeğinin (ABÇODT) psikometrik özelliklerinin Türk anne babaları için incelenmesidir. Araştırmaya Aksaray il merkezinden 4-12 yaşları arasında çocuğu olan 295 anne ve 295 baba katılmıştır. 12 senaryodan oluşan ABÇODT 7 dereceli likert tipi bir ölçektir. Ölçeğin Türkçe uyarlaması için çeviri ve tekrar çeviri süreci gerçekleştirilmiş; kapsam, anlamsal ve kavramsal eşdeğerlik için uzman görüşleri alınmıştır. Ölçme aracının güvenilirliğini değerlendirmek ve yapı geçerliğini incelemek için Doğrulayıcı Faktör Analizi (DFA) kullanılmıştır. DFA sonucu ölçeğin dört faktörlü yapısının (sosyalleştirme, cesaretlendirme, rahatsız hissetme, uyarma) olduğunu ortaya koymuştur. ABÇODT'nın güvenilir bir ölçme aracı olduğunu iç tutarlılık katsayıları, test-tekrar test değerlerinden elde edilen sonuçlar da ortaya koymuştur. ABÇODT anne babaların çocukların olumlu duygularına nasıl tepki verdiklerini değerlendirmek için kullanılabileceği gibi gelişimsel ve aile çalışmalarını ele alan araştırmalarda da kullanılabilir. Anne babaların çocukların olumlu duygularına verdikleri tepkilerin okul ve sınıf ortamına yansımalarını da incelemek isteyen eğitim araştırmalarında da ölçeğin kullanılması önerilmiştir.

Anahtar kelimeler: anne babaların duygusal tepkileri, çocukların olumlu duyguları, geçerlik, güvenirlik.

* *Corresponding Author*: Assoc. Prof. Dr., Aksaray University, Aksaray, Turkey, kilic.sukran@gmail.com, https://orcid.org/0000-0001-7411-1852
** Assoc. Prof. Dr., Artvin Çoruh University,Artvin, Turkey, haticekumandas@yahoo.com, https://orcid.org/0000-0003-3636-3690

Citation Information
Kılıç, Ş., & Kumandaş-Öztürk, H. (2019). Turkish adaptation of Parental Reactions to Children's Positive Emotions Scale: A validity and reliability study. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 12*(4), 1306-1323.

ISSN: 1308-1659

Introduction

Adults, especially parents are important individuals shaping emotional reactions of children towards cultural expectations (Halberstadt, 1991). Child rearing styles of parents (e.g., democratic, authoritarian, permissive) reflect general quality of the relationship they establish with their children besides goals and values they want to inspire to their children. On the other hand, parenting practices are described as strategies parents use in a specific context and situation in making their children reach a field academic or sports or social competence (Hart., Nelson, Robinson., Olsen, & McChoque, 1998). For instance, participating in a football match or school activities, asking questions about the friends of the child, going to museums and art galleries with the child, helping homework of the child are seen as structured parenting practices (Darling & Steinberg, 1993; Lee, Daniels, & Kissinger, 2006). The past few decades have seen rising scholarly interest in parents' socialization of children's emotion (Thompson & Meyer, 2007). Emotion socialization is different from other parenting behaviors because it reflects approach of parents related to emotion within emotional content and contexts rather than parenting styles, practices, discipline and warmth (Gottman, Katz, & Hooven, 1996). Parents shape emotions of their children by direct (e.g., parental reactions to emotion of the child) and indirect (e.g., parental modeling, social references, parents' expressing emotions in daily activities, talking about past memories full of emotion) methods (Saarni, 1993).

The contributions of the socialization processes of parental emotions on children emotional development is being studied in international literature (Denham, 1998; Denham & Grout, 1992; Gottman, Katz, & Hooven, 1997; Halberstadt & Eaton, 2003) and emotion socialization processes are examined in "Heuristic Model". In Heuristic Model of Eisenberg, Spinrad, and (1998), parental emotion socialization processes are described as discussion of parents about emotions, giving reactions to emotions of children, parental behaviors affecting emotional and social competence of children. Parental emotion socialization behavior is a multidimensional process involving parental reactions to child's emotion, parental discussing of child's emotion and showing emotion/being a model (Eisenberg et al., 1998; Morris et al., 2007). Parental reactions towards negative emotions of children are accepted as "direct" emotion socialization (Denham, Bassett, & Wyatt, 2007) and starting from individual interviews with parents, emotional awareness of parents and their belief and behaviors related to emotion expression is described as "meta-emotion philosophy (Gottman et. al., 1996). Scales developed on parental declarations about emotion socialization are widely used with American parents. Fabes, Poulin, Eisenberg, and Madden-Derdich (2002) developed coping with children's negative emotions scale (CCNES). CCNES consists of parental reactions to children's emotions. For instance, "*Problem-focused Reactions*" include supports given by mothers to their children about solving problems related to situations caused by an emotionally difficult condition. On the other hand "E*motion-focused* R*eactions*" reflect relaxing and soothing mother reactions to make child feel better when the child experiences a trouble. Also, there is "E*xpressive Encouragement*" includes reactions to encourage children express their emotions. CCNES also reflects supportive and nonsupportive reactions.

Parental socialization of children's emotions has a key role on children's learning of understanding emotions and emotion regulation skills (Morris et al., 2007) and prior studies from literature show that parental socialization of children's emotions focus on negative emotions rather than positive ones (Eisenberg et al., 2001; Ekman, 2003). The reason of why negative emotions are focused is that negative emotions are seen as a great opportunity by parents for guiding negative emotions of their children, learning their emotions and establishing close contact with their children (Dunn & Brown, 1994; Garner, Jones, & Miner, 1994; Lunkenheimer, Shields, & Cortina, 2007).

Besides Seligman and Csikszentmihalyi (2000) pointing the importance of positive emotions, first approach to the subject of positive emotions was The Brooden-and-Build Theory of Positive Emotions made by Fredrickson formulized between 1998-2001 and have a theoretical substructure based from positive psychology. According to this theory, positive emotions contribute individuals think and behave more flexible in situations when they need by expanding their thought and behavioral repertoire. This in turn creates a basis for forming of social, cognitive, physical and psychological resources for individuals. According to this theory, individuals with a more positive mood make more activities to enhance their relationships compared to individuals with negative mood. On the other hand, positive emotions help improvement of more effective cognitive processes, to think more flexible and creative while coping with stress or negative conditions (Fredrickson, 1998, 2001). Positive emotions compensate destructive effects of negative emotions and by this way contribute to survival of people and even ensure individual feel himself/herself good in the future also (Fredrickson & Joiner, 2002; Fredrickson, Mancuso, Branigan, & Tugade, 2000). As a summary of principal points to which the theory is based on; positive emotions expand thought and behavior repertoire in individuals, provides disappearance of negative emotions, enhances psychological resilience, increase psychological and physical well-being, provide forming of personal resources (Fredrickson, 2004).

The second approach in the literature is paying regard to the subjects which may be related to positive emotion socialization in the literature. For parents who pay care of healthy psychological development of children, well-being of children and healthy adaptation is their main desire. As a matter of course, among environmental factors, quality of parenting is an important power for child development (Masten & Shaffer 2006). Warm and supportive parental reactions to children's positive emotions seem to be related to psychosocial adaptation of children (Diener & Larsen, 1993). For instance, parental interaction, which is shaped by acceptance of positive emotional statements or talking about or discussing on positive emotions, is associated to a better skill of understanding of emotions (Denham & Kochanoff, 2002; Denham, Mitchell-Copeland, Strandberg, Auerbach, & Blair, 1997; Denham, Renwick-DeBardi, & Hewes, 1994) and more positive social behaviors towards teachers (McDowell & Parke, 2000) within the context of emotional competence in preschool period of children.

Socialization of positive emotions from preschool period enhances social resources of children and their communication with social networks (Fredrickson, Mancuso, Branigan, & Tugade, 2000) and, within the scope of prosocial behaviors, it is closely related to helping behaviors of children (Chapman, Zahn-Waxler, Cooperman, & Iannotti, 1987, Murphy, Shepard, Eisenberg, Fabes, & Guthrie, 1999) and children' feeling sympathy towards other individuals (Eisenberg, Fabes, & Murphy, 1996). It is

reported that children whose emphatic skills are developed are also children whose social competence is developed also and their negative affect is quite low and they can regulate their negative emotions (Eisenberg et al., 1996). Socializing positive emotions would result in children's regulation of negative emotions and social/academic experiences and feel better in the future (Tugade & Fredrickson, 2002). In addition, when positive emotions of children are socialized, another important output is that; positive emotions would improve thought and behavior repertoire of children and would improve their creative and problem-solving skills, decision making skills and make them more active learners (Fredrickson, 1998; Isen, 2000). As thought and behavior repertoire of individuals expand, their desire to be cheerful, to play games and to discover would increase also and by this way building of cognitive skills, brain development or even cardiovascular system would improve (Fredrickson, 2000; Fredrickson & Levenson, 1998).

In Turkish literature, there are three scale adaptation studies are available on parental emotional socialization. Altan (2006) focused on how parents socialize negative emotions of their children in her scale adaptation study. Ersay (2014) examined how mothers respond their children's positive and negative emotions with scale adaptation study. Kılıç & Kumandaş-Öztürk (2017) aimed to examine psychometrical properties of the parents' beliefs about children's emotions questionnaire which is an important part of parental emotion socialization and closely related to children mental health. This study is conducted based on the information that in literature, socialization of positive emotions contributes not only to social and emotional development of children but also to their cognitive development. In this direction, "Parental reactions to children's positive emotions scale" (PRCPS) was aimed to be adapted to Turkish.

Method

Research Design

This study is a quantitative research designed to adapt parental reactions to children's positive emotions scale (PRCPS) into Turkish. Quantitative research is an objective and systematic study of numerical data in order to obtain information about a property (Burns & Grove, 1993)

Sample of the Study

The study group consists of 590 people; 295 mothers and 295 fathers living in Aksaray city center. Parents were chosen according to convenience sampling out of random sampling methods for easiness of data collection. Implementations were made on a voluntary basis and data was not taken from involuntary families. Sociodemographic information related to parents and information on which age group of children parents filled up the scale for (age of the target child) is given in Table 1.

Table 1

Sociodemographic Characteristics of the Parents

Variables	Mother			Father	
	Number	%	Variables	Number	%
Age of mother			Age of father		
20-30	90	30.51	20-30	29	56.27
31-40	158	53.56	31-40	176	30.85
41-50	47	15.93	41-50	90	3.05
51- and over	0	0	51- and over	9	100
Educational level of mother			Educational level of father		
Literate	7	2.37	Literate	2	0.68
Primary school drop out	35	11.86	Primary school drop out	13	4.41
High school drop out	20	6.78	High school drop out	26	8.81
High school graduate	76	25.76	High school graduate	55	18.64
Vocational high school	23	7.80	Vocational high school	26	8.81
University drop out	5	1.69	University drop out	7	2.37
University grad.	110	37.29	University grad.	120	40.68
MD/PHD	19	6.44	MD/PHD	46	15.59
Mother's job			Father's job		
Housewife	159	53.90			
Unqualified job	21	7.12	Unqualified job	142	48.1
Semi-professional job (laborant, office management, etc.)	25	8.47	Semi-professional job (laborant, office management, etc.)	33	11.2
Professional job (doctor, teacher, etc.)	90	30.51	Professional job (doctor, teacher, etc.)	120	40.7
Age of the target child					
4	35	11.86	4	35	11.86
5	38	12.88	5	38	12.88
6	41	13.90	6	41	13.90
7	40	13.56	7	40	13.56
8	30	10.17	8	30	10.17
9	35	11.86	9	35	11.86
10	31	10.51	10	31	10.51
11	18	6.10	11	18	6.10
12	27	9.15	12	27	9.15

Data Collection Tools

Parental reactions to children's positive emotions scale (PRCPS) was developed by Ladouceur, Reid, and Jacques (2002). The PRCPS consists of a series of 12 vignettes/scenarios in which children are likely to experience positive emotions such as joy, pride, excitement, and curiosity. Each scenario takes place in different contexts (with peers or acquaintances, at a birthday party, in a car, in a restaurant, etc.), but the parent is always present. For each condition, parents indicate on a 7-point scale (from very unlikely to very likely) how likely they would be to react as described in each of the six alternative reactions. These reactions represented by the parents reflect the subscales of the scale. The PRCPS yields four subscales: socialization (α=.77) reflect degree of explanation by parents about on why expressed behaviors of their children are not appropriate according to social norms and rules of good manner (e.g., I would say my child I am interested in what s/he says but it is more appropriate to listen her/him at dinner), encouragement (α=.77), reflects degree of parental encouraging of children's positive emotions or confirming positive emotions of their children (e.g., I show my happiness to see my child having joy by smiling to him/her), reprimand (α=.80), reflect degree of parental reactions by reprimanding towards children's positive emotions (e.g., I tell my child "sit down" with a stable voice), discomfort (α=.86) reflect degree of parental embarrassment and discomfort to children's positive emotions (e.g., I feel embarrassed from the behavior of my child).

Data Collection

Aksaray University Ethical Committee approval and official permission from Provincial Directorate for National Education was obtained and parents who have children in preschool education institutions and primary schools in city center were found. A letter summarizing aim and the content of the study, scale and sociodemographic form was sent to parents under a closed cover via teachers. Voluntary parents filled up scales and form and sent under a closed cover in order to be given to researcher.

Data Analysis

In statistical analysis of the data obtained, SPSS and LISREL 8.80 package programs were used. In analysis of sociodemographic characteristics of participants, frequency and percentile analysis was used. In construct validity, confirmatory and second-level confirmatory factor analysis was used as a way of testing factor structure emerging. In language validity analysis, Pearson Product-Moment Correlation Coefficient was calculated. For reliability study, Cronbach alpha inner consistency coefficient and correlation coefficient obtained by test-retest method was calculated. For translation study, after getting necessary permissions for adaptation into Turkish from writers who developed the scale, in order to provide semantic equivalence, which is one of the phases of scale adaptation, and translation and retranslation, four academicians with good command of English, from the fields of developmental psychology, child development, and preschool, the scale was translated into Turkish from English. The Turkish form developed was retranslated into English by four different academicians. By bringing together Turkish and English translations of the scale, common characteristics were searched. In order to obtain content validity of Turkish and English form of the scale, for semantic, conceptual and experimental equality investigation, five

professionals and academicians with at least PhD were consulted and the scale was put into final form. Turkish and English forms of the scale were answered by a group of parents (s=25) whose native language is Turkish with a good command of English with a week apart. Among total points obtained from Turkish and English forms, as result of Pearson Product-Moment Correlation Coefficient, language equivalence of the scale was calculated as 0.96.

Findings

The form which is obtained after adaptation of the scale was applied to parents and its structure and psychometric characteristics in Turkey are revealed. Reliability and validity study of the data obtained in adaptation process is conducted and results are summarized.

Determining Factor Structure of the Scale- Construct Validity

In order to investigate fit of the scale on factor structure in the culture it is adapted to, Confirmatory Factor Analysis (CFA) was used. In order to evaluate CFA, path diagram, goodness of fit criteria and correction suggestions were taken into account. Appropriateness of the data for factor analysis is examined via Kaiser-Meyer-Olkin (KMO) coefficient and Barlett Sphercity Test. If KMO is over 0.60 and Barlett test is significant, this result reflected that the data is appropriate for factor analysis (Büyüköztürk, 2005). Results are obtained as (KMO=0.838; χ^2=10069.34; p=0.000). In this scope, it can be said that KMO coefficient has an acceptable sample size and according to Barlett test result, the data is proper for a normal distribution. Before starting analysis, missing data and extreme values are investigated. When missing values in the data set is examined, it is seen that these values are distributed randomly. From this point, no assignments were made. In addition, when extreme values are investigated, standard z-values were calculated first and z-values of 102 out of 798 values were excluded from data set because they are not between the range of (-3)-(+3). Then, for 48 variables, Mahalonobis distances were examined and obtained values were compared to $\aleph^2$ table value on 0.01 level. 106 values, which are over table value, were excluded from data set. By this way, 208 values were excluded from data set and analysis continued with a total of 590 individuals.

As a result of Confirmatory Factor Analysis, path diagram and goodness of fit criteria is obtained and findings are interpreted. As a result of data analysis, for the models to be confirmed, χ^2/df, RMSEA and CFI, GFI, AGFI, SRMR and NNFI was used as statistical fit criteria. In this study, fit indexes were interpreted by using criteria summarized in Table 1 (Çokluk, Şekercioğlu, & Büyüköztürk, 2010).

Table 2

Goodnes of Fit Index Criteria

Fit Indexes	Good Fit	Acceptable Fit
χ^2/df value	$0.00 \leq \chi^2/df \leq 2.00$	$2.00 \leq \chi^2/df \leq 3.00$
RMSEA	$0.00 \leq$ RMSEA ≤ 0.05	$0.05 \leq$ RMSEA ≤ 0.10
NFI	$0.95 \leq$ NFI ≤ 1.00	$0.90 \leq$NFI ≤ 0.95
NNFI	$0.97 \leq$ NNFI ≤ 1.00	$0.95 \leq$NNFI ≤ 0.97
CFI	$0.95 \leq$ CFI ≤ 1.00	$0.90 \leq$CFI ≤ 0.95
GFI	$0.95 \leq$ GFI ≤ 1.00	$0.90 \leq$GFI ≤ 0.95
AGFI	$0.90 \leq$ AGFI ≤ 1.00	$0.85 \leq$AGFI ≤ 0.90

CFA results conducted for Socialization dimension of the scale are given in Table 3 and Figure 1.

Table 3

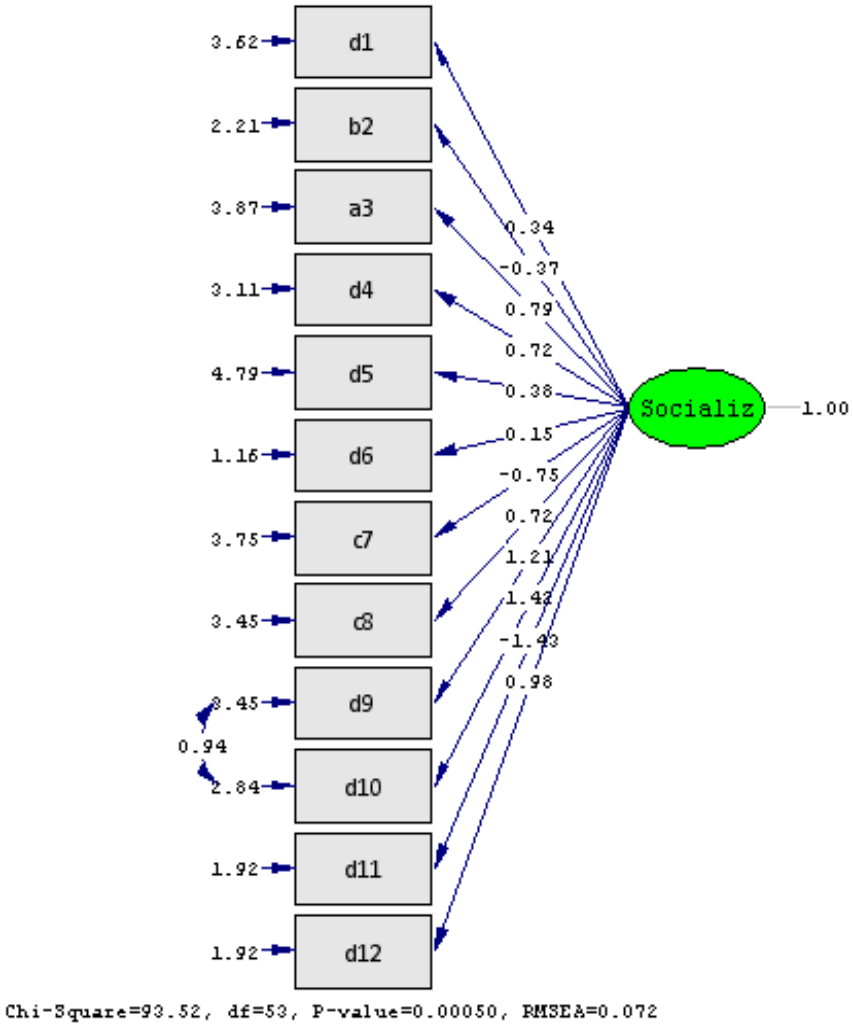
Goodnes of Fit Indexes obtained from CFA results for Socialization Dimension

Scale dimension	χ^2	*sd*	χ^2/sd	*p*	*AGFI*	*GFI*	*CFI*	*NNFI*	*SRMR*	*RMSEA*
Socialization	93.52	53	1.76	0.00	0.89	0.91	0.90	0.96	0.05	0.072

As a result of analysis, ratio of chi-square value (χ^2) of the theoretical model to degree of freedom (df) was examined. The acceptable value of this ratio should be $\chi^2/sd \leq 5$ (Kline, 2005). When the analysis is examined, this value seems to be below cut point ($\chi^2/sd=1.76$). In this respect, the model seems to have good fit.

In analysis, if RMSEA, which is one of the fit indexes, is below 0.05 it means an excellent and below 0.08 means good fit (Joreskob & Sorbom, 1993), if it is under 0.10; this means a weak fit. In this situation, fit index obtained (RMSEA= 0.072) show an acceptable fit between data and model. When other fit indexes (AGFI, GFI, NFI and SRMR) are examined, it is seen that obtained values are at an acceptable level. Confirmed structure of the scale after analysis is given in Figure 1.

Figure 1. Socialization Dimension Confirmatory Factor Analysis Diagram



CFA results conducted for encouragement dimension of the scale are given in Table 4 and Figure 2.

Table 4

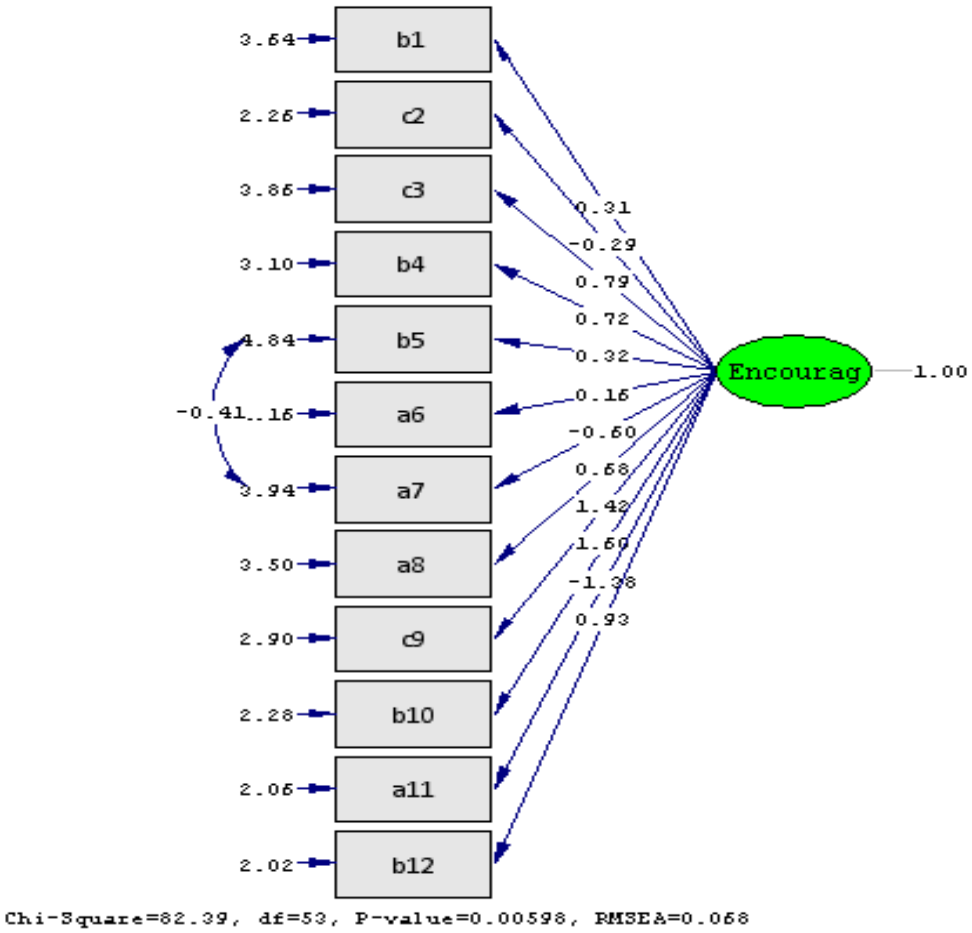
CFA Results for the Dimension of Encouragement

Scale dimension	χ^2	*sd*	χ^2/*sd*	*p*	*AGFI*	*GFI*	*CFI*	*NNFI*	*SRMR*	*RMSEA*
Encouragement	82.39	53	1.55	0.01	0.89	0.90	0.90	0.95	0.045	0.068

As a result of analysis, ratio of chi-square (χ^2) value to degree of freedom (df) is examined. When the analysis is evaluated, it is seen that this value is acceptable (χ^2/sd=1.55). From this aspect, it is seen that the model shows a good fit.

In analysis, when RMSEA, which is one of the fit indexes, is examined, 0.068 value was obtained as an acceptable fit. When other fit indexes (AGFI, GFI, NFI and SRMR) are examined, it can be seen that obtained values are at an acceptable level. Confirmed structure of the scale after analysis is given in Figure 2.

Figure 2. Encouragement Dimension Confirmatory Factor Analysis Diagram



CFA results conducted for discomfort dimension of the scale are given in Table 5 and Figure 3.

Table 5

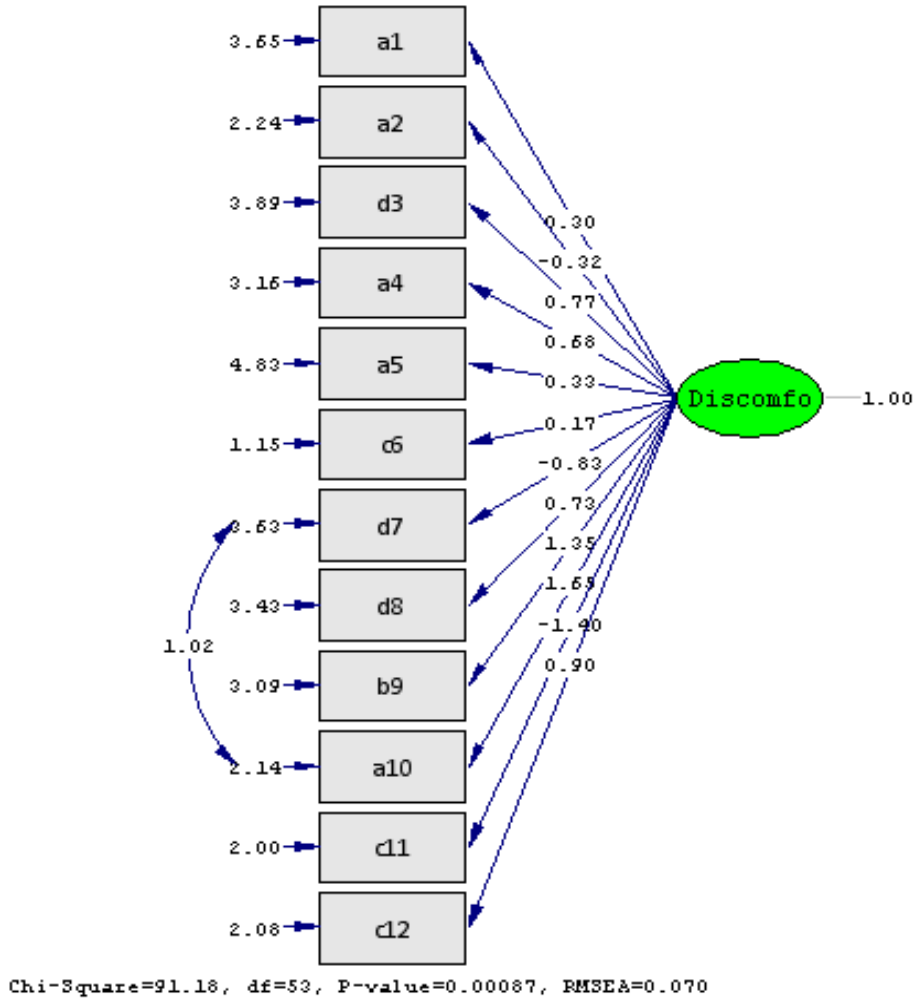
Goodness of Fit İndexes obtained from CFA Results for the Dimension of Discomfort

Scale dimension	χ^2	*sd*	χ^2/*sd*	*p*	*AGFI*	*GFI*	*CFI*	*NNFI*	*SRMR*	*RMSEA*
Discomfort	91.18	53	1.72	0.00	0.90	0.92	0.91	0.96	0.065	0.070

As a result of analysis, ratio of chi-square (א2) value to degree of freedom (df) is examined. When the analysis is evaluated, it is seen that this value is acceptable (χ^2/sd=1.72). From this aspect, it is seen that the model shows a good fit.

In analysis, RMSEA =0.070, which is one of the fit indexes, show that there is an acceptable fit between data and model. When other fit indexes (AGFI, GFI, NFI and SRMR) are examined, it can be seen that obtained values are at an acceptable level. Confirmed structure of the scale after analysis is given in Figure 3.

Figure 3. Discomfort Dimension Confirmatory Factor Analysis Diagram



CFA results conducted for reprimand dimension of the scale are given in Table 6 and Figure 4.

Table 6

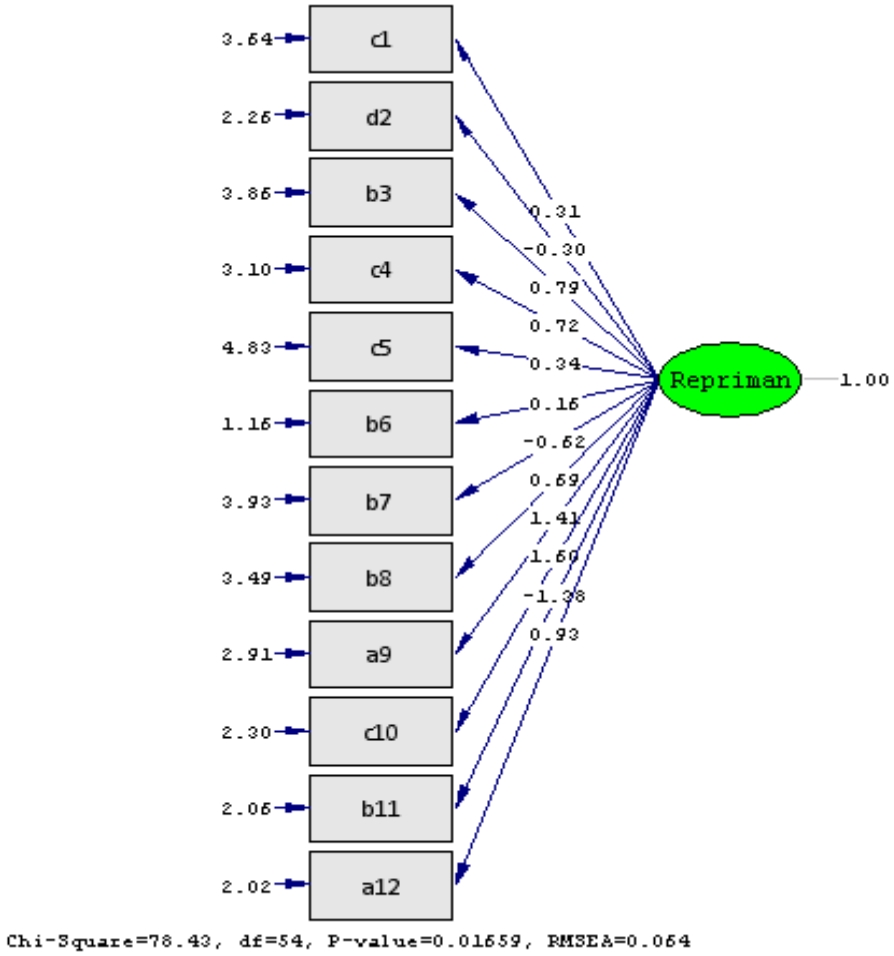
CFA Results for the Dimension of Reprimand

Scale dimension	א^2	*sd*	א^2/*sd*	*p*	*AGFI*	*GFI*	*CFI*	*NNFI*	*SRMR*	*RMSEA*
Reprimand	78.43	54	1.45	0.02	0.85	0.90	0.90	0.94	0.071	0.064

As a result of analysis, ratio of chi-square (א2) value to degree of freedom (df) is examined. When the analysis is evaluated, it is seen that this value is acceptable (2 ds / א = 1.45). From this aspect, it is seen that the model shows a good fit.

In analysis, RMSEA =0.064, which is one of the fit indexes, show that there is an acceptable fit between data and model. When other fit indexes (AGFI, GFI, NFI and SRMR) are examined, it can be seen that obtained values are at an acceptable level. Confirmed structure of the scale after analysis is given in Figure 4.

Figure 4. Reprimand Dimension Confirmatory Factor Analysis Diagram



Reliability of the Scale

Inner consistency reliability. In order to examine reliability of the scale, analyses were conducted related to Cronbach alpha and test-retest reliability. Cronbach alpha reliability coefficient of the scale is calculated as 0,724 for all dimensions and 48 items. Cronbach alpha reliability coefficients calculated for each 12 items on each of 4 sub-dimensions are given in Table 7.

Table 7

Reliability coefficients for dimensions of the scale

Dimensions	Cronbach Alpha	N	Number of Items	*P*
Socialization	0.730*	590	12	0.00**
Encouragement	0.741*	590	12	0.01*
Discomfort	0.770**	590	12	0.02*
Reprimand	0.774**	590	12	0.00**
Total scale	0.724*	590	48	0.03**

*p< .05, **p < .01

When these values are taken into account, it can be asserted that inner consistency of subscales and total scale is within acceptable limits.

Test-retest reliability. In order to find test-retest reliability, the scale is reapplied to 68 mothers/ fathers after four weeks from data obtained, Pearson Product-Moment Correlation Coefficient was calculated. Test-retest reliability coefficient was found as 0.649 for socialization dimension, 0.614 for encouragement dimension, 0.754 for discomfort dimension and 0.687 for reprimand dimension. As the result of the analysis, although the number of individuals in test retest application was not very high (N = 68), the values obtained were found to be within acceptable limits. Results of analyses are given in Table 8.

Table 8

Test-Retest Reliability of the Scale

Dimensions	Pearson's r	*N*	*p*
Socialization	0.649	68	0.02*
Encouragement	0.614	68	0.00**
Discomfort	0.754	68	0.03*
Reprimand	0.687	68	0.00**

Note: *p<.05 **p<.01

Discussion and Conclusion

The aim of this study is to give a measurement tool to evaluate parental reactions to children's positive emotions to our country. For this purpose, psychometric characteristics of PRCPS, developed by Ladouceur, Reid, and Jacques (2002), were investigated and its appropriateness for using on Turkish parents was examined using a series of validity and reliability analysis. Factor structure of the scale is measured using confirmatory factor analysis. Results of confirmatory factor analysis show that four-dimensional factor structure of the scale is confirmed. Within this context, it is seen that factor structure of the original scale is obtained in this study also. For reliability study of the scale, inner-consistency coefficient and test-retest reliability is examined. Results obtained reflect that inner consistency is satisfactory and between acceptable limits for socialization, encouragement, reprimand and discomfort. The original test-retest analysis results were .63 for socialization, .78 for encouragement, .76 for reprimand and .60 for discomfort. Test-retest reliability results obtained from the adaptation study showed similar results with the original scale. The results of test-retest analysis reflected acceptable limits for the adaptation study.

In this study, parental reactions of parents with children aged 4-12 to positive emotions of their children are measured. For this reason, it is thought that the scale can be used in studies aiming to measure parental reactions to children's positive emotions. It can be said that PRCPS, which consists of 12 scenarios, with dimensions of socialization, encouragement, reprimand and discomfort, is appropriate for Turkish parents to measure parental reactions to children's positive emotions. Having said that, the scale can also be utilized in developmental research studies as well as in research

investigating family systems. It has also been proposed to use the scale in educational research to examine the reflection of parents' reactions to positive emotions of children in the school and classroom environment.

This study, which investigates psychometric characteristics of parental reactions to children's positive emotions, is conducted with parents living in Aksaray city center. From this aspect, this condition can be accepted as a limitation to this study.

References

Altan, Ö. (2006). *The effects of maternal socialization and temperament on children's* (Unpublished master's thesis). Koç University, İstanbul.

Burns, N., & Grove, S. K. (1993). *The practice of nursing research: Conduct, critique & utilization* (2nd ed.). Elsevier Science Health Science.

Çokluk, Ö. S., Şekercioğlu, G., & Büyüköztürk, S. (2012). *Sosyal bilimler için çok değişkenli istatistik: Spss ve lisrel uygulamaları*. Ankara: Pegem Akademi Yayıncılık.

Chapman, M., Zahn-Waxler, C., Cooperman, G., & Iannotti, R. (1987). Empathy and responsibility in the motivation of children's helping. *Developmental Psychology*, *23*(1), 140-145.

Darling, N., & Steinberg, L. (1993). Parenting style as context: An integrative model. *Psychological Bulletin*, *113*(3), 487-496.

Denham, S. A. (1998). *Emotional development in young children*. The Guilford Series on Social and Emotional Development. New York: Guilford.

Denham, S. A., Bassett, H. H., & Wyatt, T. (2007). The socialization of emotional competence. In J. E. Grusec,, &, P. D. Hastings (Eds.), *Handbook of socialization: theory and research* (pp. 614-637). New York: Guilford Press.

Denham, S. A., & Grout, L. (1992). Mothers' emotional expressiveness and coping: relations with preschoolers' social-emotional competence. *Genetic, Social, and General Psychology Monographs, 118*(1), 73–101.

Denham, S. A., & Kochanoff, A. T. (2002). Parental contributions to preschoolers' understanding of emotion. *Marriage and Family Review*, *34*(3-4), 311-343.

Denham, S. A., Renwick-DeBardi, S., & Hewes, S. (1994). Emotional communication between mothers and preschoolers: Relations with emotional competence. *Merrill Palmer Quarterly*, *40*(4), 488-508.

Denham, S. A., Mitchell-Copeland, J., Strandberg, K., Auerbach, K. S., & Blair, K. (1997). Parental contributions to preschoolers' emotional competence: Direct and indirect effects. *Motivation and Emotion, 21(1)*, 65-86.

Diener, E., & Larsen, R. J. (1993). The subjective experience of emotional well-being. In M. Lewis & J. M. Haviland (Eds.), *Handbook of emotions* (pp. 405–415). New York: Guilford Press.

Dunn, J., & Brown, J. (1994). Affect expression in the family, children's understanding of emotions, and their interactions with others. *Merrill-Palmer Quartely*, *40*(1), 120-137.

Eisenberg, N., Fabes, R. A., & Murphy, B. C. (1996). Parent's reactions to children's negative emotions: Relations to children's social competence and comforting behavior. *Child Development*, *67*(5), 2227-2247.

Eisenberg, N., Spinrad, T. L., & Cumberland, A. (1998). The socialization of emotion: Reply to commentaries. *Psychological Inquiry*, *9*(4), 317-333.

Eisenberg, N., Fabes, R. A., Karbon, M., Murphy, B. C., Wosinski, M., Polazzi, L., Carlo, G., & Juhnke, C. (1996). The relations of children's dispositional prosocial

behavior to emotionality, regulation, and social functioning. *Child Development*, *67*(3), 974–992.

Eisenberg, N., Gershoff, E. T., Fabes R. A., Shepard S. A., Cumberland A. J., & Losoya S. H., et al. (2001). Mother's emotional expressivity and children's behavior problems and social competence: mediation through children's regulation. *Developmental Psychology, 37*(4), 475–490.

Ekman, P. (2003). *Emotions revealed: Recognizing faces and feelings to improve communication and life*. New York: St. Martin's Press.

Ersay, E. (2014). Parental socialization of emotion: How mothers respond to their children's emotions in Turkey. *International Journal of Emotional Education*, *6*(1), 33-46.

Fabes, R. A., Poulin, R., Eisenberg, N., & Madden-Derdich, D. A. (2002). The coping with children's negative emotions Scale (CCNES): Psychometric Properties and Relations with Children's emotional competence. *Marriage and Family Review*, *34*(3-4), 285-310.

Fredrickson, B. L. (1998). What good are positive emotions? *Review of General Psychology*, *2*(3), 300–319.

Fredrickson, B. L. (2000). *Cultivating Positive Emotions to Optimize Health and Well-Being. Prevention & Treatment.* Retrieved January 22, 2018 from https://www.wisebrain.org/papers/CultPosEmot.pdf

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology the broaden-and-build theory of positive emotions. *American Psychologist*, *56*(3), 218-226.

Fredrickson, B. L. (2004). The broaden-and-build theory of positive emotions. *Philosophical Transactions of the Royal Society B: Biological Sciences, 29*; *359*(1449), 1367–1378.

Fredrickson, B. L., & Levenson, R. W. (1998). Positive emotions speed recovery from the cardiovascular sequelae of negative emotions. *Cognition & Emotion*, *12*(2), 191-220.

Fredrickson, B. L., & Joiner, T. E. (2002). Positive emotions trigger upward spirals toward emotional well-being. *Psychological Science*, *13*(2), 172–175.

Fredrickson, B. L., Mancuso, R. A, Branigan, C., & Tugade, M. (2000). The undoing effect of positive emotions. *Motivation and Emotion*, *24*(4), 237–258.

Garner, P. W., Jones, D. C., & Miner, J. L. (1994). Social competence among low-income preschoolers: emotion socialization practices and social cognitive correlates. *Child Development*, *65*(2), 662-637.

Gottman, J. M., Katz, L. F., & Hooven, C. (1996). Parental meta-emotion philosophy and the emotional life of families: Theoretical models and preliminary data. *Journal of Family Psychology, 10*(3), 243-268.

Gottman, J. M., Katz, L. F., & Hooven, C. (1997). *Meta-emotion: How families communicate emotionally*. Mahwah, NJ: Lawrence Erlbaum Associates.

Halberstadt, A. G. (1991). Socialization of expressiveness: Family influences in particular and a model in general. In R. S. Feldman & S. Rime (Eds.),

Fundamentals of emotional expressiveness (pp. 106-162). Cambridge, U.K.: Cambridge University.

Halberstadt, A. G., & Eaton, K. L. (2002). A meta-analysis of family expressiveness and children's emotion expressiveness and understanding, *Marriage & Family Review*, *34*(1-2), 35-62.

Hart, C. H., Nelson, D. A., Robinson, C. C., Olsen. F., & Mc-Choque, M. K. (1998). Overt and relational aggression in Russian nursery-school age children: Parenting style and marital linkages. *Developmental Psychology*, *34*(4), 687-697.

Isen, A. M. (2000). Positive affect and decision making. In M. Lewis, & J. Haviland (Eds.), *Handbook of emotions* (pp. 417-435) (2nd ed.). New York: Guilford Press.

Kılıç, Ş., & Kumandaş-Öztürk, H. (2017). Anne babaların çocukların duyguları hakkındaki inanışları ölçeğinin geçerlik ve güvenirlik çalışması. *Anadolu Psikiyatri Dergisi*, *18*(2), 169-178.

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York: Guilford.

Ladouceur, C., Reid, L., & Jacques, A. (2002). Construction et validation du Questionnaire sur les réactions parentales aux émotions positives exprimées par l'enfant [Construction and validation of the Questionnaire on Parental Reactions to Children's Expression of Positive Emotions]. *Canadian Journal of Behavioural Science / Revue canadienne des sciences du comportement, 34*(1), 8-18.

Lee, S. M., Daniels M. H., & Kissinger, D. B. (2006). Parental influences on adolescent adjustment: Parenting styles versus parenting practices. *The Family Journal: Counseling and Therapy For Couples and Families*, *14*(3), 253-259.

Lunkenheimer, E. S., Shileds, A. M., & Cortina, K. S. (2007). Parental emotion coaching and dismissing in family interaction. In M. Lewis & J. Haviland (Eds.), *The handbook of emotions* (pp. 563-573). New York: Guilford Press.

Masten, A. S., & Shaffer, A. (2006). How families matter in child development: reflections from research on risk and resilience. In Clarke-Stewart A, Dunn J (Eds.), *Families count: Effects on child and adolescent development* (pp. 5–25). Cambridge, UK: Cambridge University Press.

Mcdowell, D., & Parke, R. D. (2005). Parental control and affect as predictors of children's display rule use and social competence with peers. *Social Development*, *14*(3), 440-457.

Morris, A., Silk, S. J., Steinberg, L., Robinson, L., Myers, S. S., & Robinson, L. R. (2007). The role of the family context in the development of emotion regulation. *Social Development*, *16*(2), 361-388.

Murphy, B. C., Shepard, S. A., Eisenberg, N., Fabes, R. A., & Guthrie, I. K. (1999). Contemporaneous and longitudinal relations of dispositional sympathy to emotionality, regulation, and social functioning. *The Journal of Early Adolescence*, *19*(1), 66-97.

Saarni, C. (1993). Socialization of emotion. In Lewis M., & Haviland, J. M (Eds.), *Handbook of emotions* (pp. 435–446). New York, NY US: Guilford Press.

Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist*, *55*(1), 5-14.

Thompson, R. A., & Meyer, S. (2007). The socialization of emotion regulation in the family. In J. Gross (Ed.), Handbook of emotion regulation (pp. 249-268). Nueva York: The Guilford Press.

Tugade, M. M., & Fredrickson, B. L. (2002). Positive emotions and emotional intelligence. In Barrett L. Feldman & P. Salovey (Eds.), *The wisdom of feelings* (pp. 319–340). New York: Guilford.

Journal of Theoretical Educational Science, 12(4), 1324-1339, October 2019
Kuramsal Eğitimbilim Dergisi, 12(4), 1324-1339, Ekim 2019
[Online]: https://dergipark.org.tr/akukeg
DOI number: http://dx.doi.org/10.30831/akukeg.524688

Education Themed Movies as a Teaching Material for Pre-Service Science Teacher Education*

Fen Bilgisi Öğretmen Adaylarının Eğitiminde Bir Öğretim Materyali Olarak Eğitim Temalı Filmler

Ridvan ELMAS** **Muhammet Emin TURKOGLU***** **Bulent AYDOGDU******

Received: 08 February 2019 **Research Article** **Accepted:** 04 August 2019

ABSTRACT: Educational media has the potential to foster pre-service science teacher education in many ways. The purpose of this study was to explore the possibility of using selected movies as an educational media and resource for pre-service science teacher education as an extracurricular activity, and therefore five selected movies were used as a backbone for a seven-week training. The sample of the study consisted of 60 pre-service science teachers who attended this training. The data were collected through 3 instruments as pre and posttests. These are Teachers' Sense of Efficacy Scale (TSES), The Science Teaching Efficacy Belief Instrument (STEBI) and Draw-A-Science-Teacher-Test-Checklist (DASTT-C), respectively. For the first two instruments, a dependent t-test was carried out as a statistical procedure with SPSS. The DASTT-C drawings were evaluated according to its scoring sheet. The results indicated that there is a statistically significant increase in both pre-service science teachers' efficacy beliefs and their science teaching efficacy beliefs based on our statistical analysis. Pre-service science teachers presented more student-centered instructional style qualifications after the training.

Keywords: Movies, pre-service science teacher education, teachers' sense of efficacy scale, science teaching efficacy belief, draw-a-science-teacher-test-checklist.

ÖZ: Eğitime dayalı medya araçları öğretmen adaylarının potansiyellerini geliştirmede etkili bir araçtır. Bu çalışmanın amacı, fen bilgisi öğretmen adaylarının eğitiminde öğretim programını desteklemek amacıyla seçilen bazı filmlerin öğretim aracı olarak kullanılmasıdır. Bu bağlamda seçilen beş film, yedi haftalık eğitimin ana unsurunu oluşturmaktadır. Araştırmanın örneklemini, 60 fen bilgisi öğretmen adayı oluşturmaktadır. Veriler, ön-test ve son-test olarak üç veri toplama aracıyla toplanmıştır. Araştırmada kullanılan ölçekler, Öğretmen Öz-yeterlik Ölçeği (ÖÖÖ), Fen Öğretimi Öz-Yeterlik İnancı Ölçeği (FÖYİÖ), Fen Öğretmeni Olarak Kendini Çizme Testi (DASTT-C) şeklindedir. İlk iki ölçek için, SPSS istatistiksel paket programı ile bağımlı örneklemler t testi yapılmıştır. DASTT-C çizimleri için ise, dereceli ölçeğe göre değerlendirilmiştir. Sonuçlar, fen bilgisi öğretmen adaylarının hem öğretmen öz-yeterlik inanç son test puanlarında hem de fen öğretimi öz-yeterlik inanç son test puanlarında anlamlı farklılıklar olduğunu göstermiştir. Eğitimden sonra, fen bilgisi öğretmen adaylarının daha fazla öğrenci merkezli öğretim tarzı sergiledikleri görülmüştür.

Anahtar Sözcükler: filmler, fen bilgisi öğretmen adaylarının eğitimi, öğretmen öz-yeterlik ölçeği, fen öğretimi öz-yeterlik inancı, fen öğretmeni olarak kendini çizme testi.

* This study was funded by Afyon Kocatepe University Scientific Projects Coordination Center (Project Number: 16.EGT.03). Besides, this study was presented as an oral presentation in 5th International Eurasian Educational Research Congress (EJER) 2018.
** Asst. Prof. Dr., Afyon Kocatepe University, Afyonkarahisar, Turkey, relmas@aku.edu.tr, https://orcid.org/0000-0001-7769-2525
*** *Corresponding Author*: Asst. Prof. Dr., Afyon Kocatepe University, Afyonkarahisar, mturkoglu@aku.edu.tr, https://orcid.org/0000-0003-3883-3414
**** Assoc. Prof. Dr., Afyon Kocatepe University, Afyonkarahisar, baydogdu@aku.edu.tr, https://orcid.org/0000-0003-1989-6081

Citation Information
Elmas, R., Turkoglu, M. E., & Aydogdu, B. (2019). Education themed movies as a teaching resource for pre-service science teacher education. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science]*, *12*(4), 1324-1339.

ISSN: 1308-1659

Introduction

Teachers support students to develop their abilities, attitudes and other forms of behavior (Yildirim & Koklukaya, 2017). Teachers are seen as the most important stakeholders in the education of students (Karatas, Ardic, & Oral, 2017). As it is known, teaching is a profession that has many qualities in different dimensions. It is crucial that pre-service teachers who are trained in the faculties of education realize that their experience in teaching cannot be achieved only with a limited number of courses taken at school. When pre-service teachers exhibit a positive attitude towards their profession, it is clear that they are more likely to be more successful in the teaching profession. Therefore, there is a need for activities and good examples where pre-service teachers can see the difference between real teaching at schools and practice at faculties. One of the sources that can meet this need is the use of movies in the education of pre-service teachers. Especially teacher and school themed movies are thought to be a rich source for pre-service teachers (Berk, 2009). The use of movies in the teaching process dramatically enhances the communication between the teacher and the student (Blasco, Moreto, Blasko, Levites, & Janaudis, 2015). As it is known, life in schools predominantly takes place in classrooms. When it is considered that teachers and students interact for long hours at school, the time and quality of education should be enhanced. The main factor that will increase this duration and quality is teachers' classroom management skills. It is stated that these skills have a crucial importance in attracting the attention of the students, fostering goal orientation, increasing class participation, creating a healthy class climate and transforming students into productive individuals (Acikgoz, Ozkal & Kilic, 2003; Evertson, Emmer, Sanford, & Clements, 1983; Sahin & Ozbay, 1999). Classroom management skills are a concept that makes learning environments healthy in classrooms. These skills also direct students by applying the class rules. Effective classroom management skills allow teachers to take measures to ensure that their education and training activities are carried out efficiently to positively direct their behaviors and thoughts as a model to their students in the classroom.

Classroom management skills include many methods and activities. In particular, supervising the fulfillment of the responsibilities assigned to the students and implementing methods and techniques that facilitate teaching are among the primary ones (Shechtman & Leichtentritt, 2004). In addition to this, reminding students, taking care of them individually, ensuring that they have access to the right resources in subjects with learning needs are also used (Turnuklu & Yildiz, 2002). Teachers sometimes do not intervene in a class by classifying events and accepting specific problems under the tolerable threshold. They take some precautions by attracting the attention of the class inappropriate times or by making personal warnings. As an example of the measures that teachers take in the classroom, effective classroom rules can be shown (Gable, Hester, Rock, & Hughes, 2009). On the other hand, it is known that many teachers recognize their students individually and act needs-oriented (Sahin & Ozbay, 1999). Effective communication is an undeniable fact of increasing the efficiency of students in classroom settings (Alderman & Green, 2011). In the light of these considerations, to enable teachers to develop effective and fast strategies in the classroom management, which has become more complicated in the present day,

activities should be carried out for pre-service teachers based on today's knowledge and research results.

Teachers' self-efficacy, which is related to classroom management skills that provide teachers' effectiveness within the classroom, is another factor that causes teachers to make the classroom climate healthier (Hoy & Spero, 2005; Roberts & Henson, 2001; Woolfolk & Hoy, 1990; Woolfolk, Rosoff, & Hoy, 1990). Teachers' high self-efficacy has positive effects on their students as well as supporting educational and teaching processes. It is stated that self-efficacy is highly effective in achieving the goals and classroom management (Hoy & Spero, 2005; Roberts & Henson, 2001; Savran & Cakiroglu, 2003). It is suggested that teachers with high self-efficacy will also have high classroom management skills (Blackbourn et. al. 2007). Based on the idea that teachers' self-efficacy and classroom management skills are fundamental in the school and classroom environments where future generations grow, it is critical to organize different learning-teaching activities with rich learning and teaching objectives. It is also essential to improve the qualifications of pre-service teachers who will prepare their students for the future in the best possible way.

In the literature, the concept of efficacy is used in the form of teaching effectiveness, general competence, personal competence, teacher self-efficacy, personal teaching efficacy and such (Coladarci & Donaldson, 1991). Self-efficacy is a concept that is based on the wealth of experience of a person (Okutan & Kahveci, 2012; Ozerkan, 2007). The individual's self-efficacy perception is of great importance in developing personal motivation and effective in decision-making (Usher & Pajares, 2008). Teacher self-efficacy refers to the perceptions of teachers about their capacities in achieving the goals previously set in teaching (Ruble, Usher, & McGrew, 2011). There are many factors that affect teachers' self-efficacy. These factors include the teacher's sense of personal accomplishment, sense of professional satisfaction, sense of commitment (Zee & Koomen 2010), and nature of a teacher's field knowledge (Egyed & Short, 2006; Marri, Ahn, Fletcher, Heng, & Hatch, 2012). In light of these considerations, teacher self-efficacy can make positive changes in classroom management.

Bases on researchers' experience, the concepts related to school and teaching were defined in 6 dimensions to identify better and find solutions to these problems experienced by teachers. These dimensions are (i) the role of the teacher, (ii) the role of the student (iii) the role of the family (iv) the school management, (v) the physical conditions, and (vi) the classroom management. It is thought that these problems mostly focus on teaching role and classroom management. Based on these considerations, there is a need for activities to develop pre-service teachers' self-efficacy and classroom management skills so they can easily adapt to more qualified, combative and social changes.

Today, movies have become a part of the lives of individuals. The manipulative effect of movies on human behavior is a known fact. Movies are known to cause profound emotional effects in humans. These influences can be thought to be caused by some of the striking scenes in the movies, movie music, or actors (Berk, 2009). Teachers, especially in the first years of their teaching profession have great difficulties and troubles because of lack of experience (Kaskaya, Unlu, Akar, & Ozturan, 2011). In this manner, teacher training programs should provide diverse opportunities for pre-

service teachers. Movies can provide a context for some sample cases and how to behave when the teachers faced similar situations. Using movies as a context might give the advantage of perceptions of relevance and psychological effects (Choi, & Song, 1996; Elmas & Eryilmaz, 2015).

The first significant work to produce audio-visual training tools by the Ministry of Education was in 1951. In order to replicate the tutorial and educational movies in Turkey, the Movie Center was established. However, using training movies has been limited to representations made without a scientific perspective, in Turkey (Yakar, 2013). Movies are now used in many areas for students' education (Yildirim, Koklukaya, & Selvi, 2015). One of these is the studies aimed at providing moral education through important stories and events described in the movies (Carr, 2006). Taking into consideration the developmental level of the students, it is important for teachers to examine and select the movies he/she will use in the classroom (Akbas, Canoglu, & Ceylan, 2015; Yakar, 2013). In recent years, many studies related to movies have been done. Pekdag (2010) studied the role of using chemistry-themed movies in chemistry education. To do this, chemistry-themed movies have been determined to increase students' interest in chemistry. It is important that movies promote professional development and should be used in pieces of training for similar positive effects (Blasco, Moreto, Blasko, Levites, & Janaudis, 2015). Studies have been conducted on how to effectively use movies in education (Michel & Roebers, 2008; Michel, Roebers, & Schneider, 2007). Examples of the use of movies related to pre-service teachers are also available (Guven Yildirim, 2015). The study by Kaskaya, Unlu, Akar and Ozturan (2011) indicate that movies lead to a significant change in the professional attitudes and self-efficacy of pre-service teachers. Similarly, in a study by Polat and Akcan (2017), education-themed movies were examined in terms of multicultural education. According to the results of this study, it was stated that some multicultural indicators (Statement of principles, school employees, the attitude of school employees, curriculum, teaching strategies, and materials) were reached. The following questions were generated to find answers in the study:

1. What is the effect of education-themed movies training on teacher efficacy?
2. What is the effect of education-themed movies training on science teaching efficacy?
3. How is the position of pre-service teachers between student-centered or teacher-centered approaches?

Method

Research Design

In this study, one-group pretest-posttest design was used (Fraenkel, Wallen, & Hyun, 2011). It is important to ensure internal validity in every research. Internal validity is the result of a causal relationship with the variables in the study (Karasar, 2004). Therefore, in this study some measures were taken: *(i)* 7-week period was determined for the effect to occur; *(ii)* The same measurement tools were applied as pre-test and post-test; *(iii)* All students participated in the 7-week training, so that the measurement tools were applied to the same group as pre-test and post-test; *(iv)* Voluntary participation of students was encouraged so there was no participant loss and

absenteeism. On the other hand, due to the absence of the control group in the design, it is difficult to argue that the difference between pre-test and post-test is only due to the training process. This is the limitation of this design.

Sample

The sample consists of a total of 60 students at each grade level (from first through fourth grades) who are studying at the department of science education at the faculty of education in an Anatolian university in the second half of 2016-2017. A pilot study was conducted for seven weeks in April and May 2016 (a year ago) so the students who had not participated in the pilot study enrolled the training.

Instruments

Teachers' Sense of Efficacy Scale (TSES): The scale was originally developed by Tschannen-Moran and Hoy (2001) and adapted to Turkish by Capa, Cakiroglu, and Sarikaya (2005). The scale used in the study consists of 24 items and three factors. The first factor, Self-Efficacy for Students Engagement, consists of 8 items; the second factor, Efficacy for Instructional Strategies, consists of 8 items; and the third factor, Efficacy for Classroom Management, consists of 8 items. The reliability of the scale was 0.82 for the first factor, 0.86 for the second factor and 0.84 for the third factor, and 0.93 for the overall scale. In the present study, these values were 0.83, 0.86, 052 and 0.85, respectively for the factors.

The Science Teaching Efficacy Belief Instrument (STEBI): The scale was initially developed by Enochs and Riggs (1990) and adapted to Turkish by Tekkaya, Cakiroglu, and Ozkan, (2002). The scale used in the study consists of 23 items and two factors. The first factor, Personal Science Teaching Efficacy Beliefs (PSTEB), consists of 13 items and the second factor, Personal Science Teaching Outcome Expectancy Scale (PSTOES) consists of 10 items. The reliability of the scale was 0.86 for the first factor and 0.79 for the second factor (Tekkaya, Cakiroglu, & Ozkan, 2002). In the present study, these values were 0.67 for the first factor, 0.54 for the second factor and 0.78 for the whole scale. Low reliability values are thought to be due to the small sample size.

Draw-A-Science-Teacher-Test-Checklist (DASTT-C): The test was initially been adapted from the "Draw a Scientist Test (DAST)," which is used to explore students' perceptions and images about scientists (Chambers, 1983). Finson, Beaver, and Crammond (1995) revised DAST as DAST-C. DAST-C was later developed into the Draw-A-Science-Teacher-Test-Checklist (DASTT-C) to determine the teaching style of teachers and students (Thomas & Pedersen, 1998; Thomas, Pedersen, & Finson, 2001). Many researchers have used DASTT-C to explore the opinions of pre-service teachers and students on teaching (Akkus, 2013; Buldur, 2017; Duban, 2013; Elmas, Demirdogen, & Geban, 2011; Tatar, 2015; Yilmaz, Turkmen, Pederson & Huyuguzel-Cavas, 2007). In this study, DASTT-C was used as a data collection tool. The students were asked in DASTT-C to "draw their pictures as a science teacher at school" and briefly explain the drawings, and to answer the questions "what the teacher did" and "what the student did."

Training Process

This study includes a seven-week training process. In the first and last weeks, pre and post-tests were done. In the remaining five weeks, all pre-service teachers were asked to watch the predetermined movie for the training each week. After the movie had been watched, pre-service teachers attended 2-hour-training, each week. The movies selected within the scope of this study were determined through a site that made movie trailers and promotions on the Internet. 3 researchers held 2 separate meetings to identify the films. In the first meeting, different films were scanned by the researchers and especially the films in which the teacher played an active role were determined. In 2 meetings, 10 of the 15 films identified in the previous meeting were eliminated and 5 films were decided to be used in the seven-week training process. In addition to the active role of the teacher, films with high interaction with family, school and school management were the main reasons for the selection of the 5 movies. One of the movies selected in the previous year's pilot study was changed because in the pilot study, 5 films were tried with a different group, and one film was replaced by a different film because of the feedback received from the pilot group. Since the pilot study was conducted with a different group of students 1 year ago, 5 movies were included in the training. Finally, the following movies were used: (Table 1).

Table 1

Training Process

Pre-test	Application/Training movies	Post-test
1. Teachers' Sense of Efficacy Scale (TSES) 2. The Science Teaching Efficacy Belief Instrument (STEBI) 3. Draw-A-Science-Teacher-Test-Checklist (DASTT-C)	1. Dead Poets Society, 1989 2. Like Stars on Earth, 2007 3. October Sky, 1999 4. 3 Idiots, 2009 5. İmkânsız Olasılık (2016)	1. Teachers' Sense of Efficacy Scale (TSES) 2. The Science Teaching Efficacy Belief Instrument (STEBI) 3. Draw-A-Science-Teacher-Test-Checklist (DASTT-C)

During the training process, for each week a trainer was determined to conduct the course. In this training, the content that is especially emphasized about the movies during the courses is given in the table below (Table 2). During the courses, questionnaire and discussion methods were used. The movies were discussed and evaluated by pre-service teachers in terms of six basic dimensions of education, every week. These dimensions were (a) the role of the teacher, (b) the role of the student, (c) the role of the family, (d) the role of school management, (e) physical conditions and (f) the classroom climate (atmosphere and management). Together with a researcher who conducted the course, a second researcher participated in supporting education and observing the process. Trainers and observers were coded as T1, T2, T3 and O1, O2 and O3.

Table 2

Training Program Application Process

Movies	Content	Trainer	Observer
Dead Poets Society, 1989	-The conservative attitude of the school administration, teachers and families -The extraordinarily disciplined and prescriptive school environment -The unusual struggle of the new teacher against the status quo, -Students are affected by the new teacher, -Students discover their potential, -Students begin to change, they are emancipated and the costs they pay as a result.	T1	O1
Like Stars on Earth, 2007	-School life of a student with learning disabilities -Teachers and family who are not aware of learning difficulties -Student's school change -Arts teacher's great awareness of the student's problem and his struggle. -Arts teacher's realization of student's potential -Student's self-realization through the teacher	T1	O1
October Sky, 1999	-Supporting and motivating role of the teacher -The work of the student to make his rocket with perseverance -The supportive attitude of the mother; and the father's prohibitive role -The school management's supporting position -The changes in the physical conditions of the class within years -Non-supporting class climate	T2	O2
3 Idiots, 2009	-Teachers being authoritarian, traditional and stereotyped -Competitive student training -Unlike the class, some students use reasoning, questioning, curiosity and high-level thinking skills. -Teacher-centered classrooms -The traditional understanding of school management	T3	O3
Imkansiz Olasilik (2016)	-The traditional understanding of school management -Open-ended exams that measure superior skills -The combative, self-confident, problem-solving, sensible, curious students -A flexible, participatory and extraordinary teacher -Student-centered classroom -Vulnerable school climate	T3	O3

Pre-service science teachers had the opportunity to analyze and evaluate the movies from the above list within the mentioned six dimensions. They received a total of 10 hours of training throughout the research.

Analysis of Data

Teacher's Sense of Efficacy Scale (TSES) and The Science Teaching Efficacy Belief Instrument (STEBI): In the quantitative analysis, SPSS software was used to analyze the data. The data related to TSES and STEBI scales show that the data was normally distributed and Dependent groups t-test was applied to the pre-test and post-test scores of the Teacher's Sense of Efficacy Scale (TSES) and the Science Teaching Efficacy Belief Instrument (STEBI).

Draw A Science Teacher Test-Checklist (DASTT-C): Draw A Science Teacher Test-Checklist (DASTT-C) was used with its scoring sheet, and according to the scoring value, students' appreciation of student-centered/teacher-centered educational dimensions was determined.

Findings

Findings of Teacher's Sense of Efficacy Scale (TSES) and The Science Teaching Efficacy Belief Instrument (STEBI): Normality Test of the Data: Since the sample size was higher than 50, the Kolmogorov-Smirnov normality test was performed, and the data were found to be normal. The p (sig) value greater than 0.05 which means that the normality of the data was provided. The values of skewness and kurtosis are each diveded into standart error and these values were between -1.96 and 1.96. According to Can (2014) if the values are between -1.96 and 1.96, the data shows normal distribution. In Table 3, t-test results of dependent groups are given for pre-test and post-test scores of pre-service teachers for self-efficacy and teacher self-efficacy for science teaching.

Table 3

The t-test Results of Science Teaching Efficacy Belief and Teacher's Sense of Efficacy for Pre-Test and Post-Test scores of Pre-Service Science Teachers

Scales	Groups	N	Average	SD	*t*	*p*	Significance
The Science Teaching Efficacy Belief	Pre-test	60	78.45	7.92	-5.114	0.000*	Post-test; pre-test
	Post-test	60	83.35	9.04			
Teacher's Sense of Efficacy	Pre-test	60	160.10	22.61	-3.107	0.003*	Post-test; pre-test
	Post-test	60	167.38	17.95			

**p<0.01*

When Table 3 is examined, it is seen that there is a significant difference between teachers' self-efficacy and teacher self-efficacy pre-test and post-test scores for science teaching in favor of post-test scores.

Findings of Draw A Science Teacher Test-Checklist (DASTT-C): According to the results of DASTT-C, it is observed that the pre-service teachers shift towards a more student-centered education approach (Table 4). In the beginning, 13 pre-service teachers made a student-centered drawing, and as a result of the training program, this number increased from 13 to 24 and increased by 11 people. Also, there were 23 pre-service teachers in the mixed model, and this number rose to 24 by the end of the training.

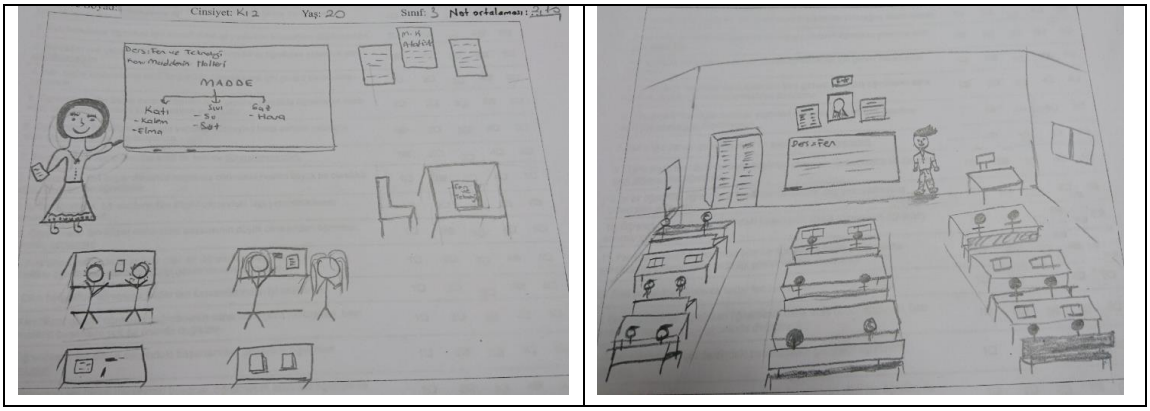
Table 4

Results of Draw A Science Teacher Test-Checklist

Type	Pre-test	Post-test
Student-centered	13	24
Mixed model	23	24
Teacher-centered	24	12
Total	60	60

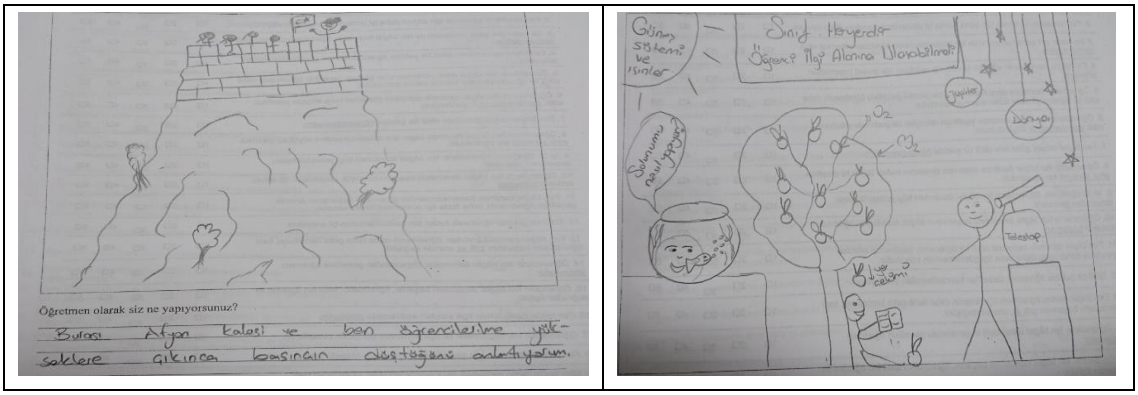
Two teacher-centered drawings are shown below. The transition from teacher-centered course-handling to student-centered course-handling style is a challenging process that requires awareness (Figure 1).

Figure 1. Examples of Teacher-Centered Drawings



While the number of pre-service teachers with a student-centered approach was 13 in the first drawings, this number rose to 24 after the training. According to qualitative analysis results, the transition of 11 pre-service teachers to student-centered understanding represents a 30 percent increase in proportion.The qualitative evidence presented that the education given to the students is also valid for developing their instructional style including more figures from student-centered teaching. Two student-centered pre-service teacher drawings are provided below (Figure 2).

Figure 2. Student-Centered Drawing Examples



As can be seen in the drawings, student-centered understanding requires more flexible and creative individuals. In informal interviews with students, it is determined

that they have an idea about how they should meet with student-centered educational examples throughout their education and how student-centered education should be done.

Discussion and Conclusions

The self-efficacy beliefs of pre-service teachers constitute the basis of the perception of success when they start the teaching profession (Henson, 2001). Using movies as an instructional tool is useful in the development of self-efficacy beliefs of pre-service teachers (Kaskaya, Unlu, Akar, & Ozturan, 2011; Lafferty, 2016). Movies can support learning if used to reflect school life (Grant, 2002). Consequently, it may well be argued that movies have a huge role in shaping up the society (Yurdigül, 2014). This study pinpoints that teacher and school themed movies are powerful tools that can be used to reveal the potential of pre-service teachers' self-efficacy. Results indicated that self-efficacy perceptions of pre-service teachers reached a better level after the training. Although pre-service teachers' self-efficacy perceptions were found to be at a reasonable level, a statistically significant difference in favor of the last test suggests that a short-term education can also increase the positive perception to a better level. The fact that the interest of the pre-service teachers and their expectations about the training was observed at a high level throughout the study supports this finding. Today, movies are becoming an essential component of educating students with uplifted self-efficacy. Yaman, Koray, and Altuncekic (2004) point out that the efficacy of pre-service teachers should reach a high level at faculties. Kiremit and Gokler (2010) state that the high level of efficacy beliefs of the pre-service teachers is of great importance both for personal development and for future students. Askar and Umay (2001) draw attention to the importance of educating individuals with high self-efficacy. Individuals with high self-efficacy perception are determined, challenging, patient and success-oriented individuals. Hoy and Spero (2005) argue that self-efficacy perception is related to the classroom management skills of teachers and this is necessary for a qualified class climate. According to Coban and Sanalan (2002), self-efficacy perception increases the future teaching performance of pre-service teachers. For this purpose, it is of great importance to conduct studies to improve the self-efficacy of the pre-service teachers. Ekici (2008) states that pre-service teachers who have self-efficacy can take on essential tasks in the development of the country.

This study also showed that pre-service science teachers' science teaching efficacy beliefs increased to a better level. This meant given training helped reinforce science teaching efficacy as well as the sense of efficacy. Bikmaz (2002) states that it is of great importance to identify candidates who have low science teaching efficacy before starting teaching profession. Because teachers who conduct science courses in schools are expected to have a high level of science self-efficacy (Kucuk, Altin, & Palic, 2013), it is clear that teacher training institutions should play an active role in the creation of teaching environments where pre-service teachers can demonstrate their competencies. These institutions should also provide competencies in the subject of science (Morgil, Secken, & Yucel, 2004; Yildirim, Koklukaya, & Selvi, 2015).

The findings of the draw a science teacher test-checklist revealed that the pre-service teachers developed from a teacher-centered approach towards a student-centered education approach after the training. Before the training, only 13 pre-service teachers made a student-centered drawing, and after the end of the training, 24 pre-service

teachers made a student-centered drawing. The increase in student-centered drawings is promising for the change in the perceptions of pre-service teachers about the future. This change in the perceptions will lead to a student-centered attitude of pre-service science teachers in future learning environments. Doymus, Simsek, and Bayrakceken (2004) state that student-centered training plays a critical role in increasing academic achievement and in students' positive attitudes towards courses. Pre-service science teachers' student-centered attitude towards their future students can both increase academic achievement and increase interest in science.

In conclusion, study findings showed that movies are essential tools to support pre-service teacher training. For this reason, the use of movies in pre-service teacher education programs can support teacher efficacy and science teaching efficacy. The study indicates that it may only be possible to create a student-centered approach by raising awareness. Consequently, school-themed movies used in this study have been observed to have an impact. Therefore, activities which enhance teacher efficacy and science teaching efficacy should be included in the curricula of faculties of education. In particular, increasing the quality of pre-service teachers' teaching practices and providing appropriate feedback can produce useful results. Moreover, similar training for pre-service teachers will provide positive contributions to our education system.

Limitations

The duration of the study was short. Therefore, this may mean that the effect may be temporary. Generally, it is recommended to perform more extended periods for permanent attitude changes. Despite this, the generally favorable situation determined by the observation in the students revealed the necessity to report the findings. Also, both qualitative and quantitative data were collected. After a certain period, it may be beneficial for the same students to be re-measured and looked at the permanence of the change, but the possibilities and limitations in the scope of this project caused the process to be reported in this way.

References

Acıkgoz, K. U., Ozkal, N., & Kilic, A. G. (2003). Öğretmen adaylarının sınıf atmosferine ilişkin algıları. Hacettepe University Journal of Education, *25*, 1-7.

Akbas, O., Canoglu, S. N., & Ceylan, M. (2015). Eğitsel kısa film ve videoları yeniden düşünmek: Eğitsel kısa film ve video yarışmasına ilişkin bir değerlendirme. *Journal of Theoretical Educational Science, 8*(2), 282-296.

Akkus, H. (2013). Pre-service secondary science teachers' images about themselves as science teachers. *Journal of Baltic Science Education, 12*(2), 249-260.

Alderman, G. L., & Green, S. K. (2011). Social powers and effective classroom management: enhancing teacher-student relationships. *Intervention in School and Clinic, 47*(1), 39-44.

Askar, P., & Umay, A. (2001). İlköğretim matematik öğretmenliği öğrencilerinin bilgisayarla ilgili öz-yeterlik algısı. *Hacettepe University Journal of Education, 21*, 1-8.

Berk, R. A. (2009). Multimedia teaching with video clips: TV, movies, youtube, and mtvu in the college classroom. *International Journal of Technology in Teaching & Learning, 5*(1), 1-21.

Bikmaz, F. H. (2002). Fen öğretiminde öz-yeterlik inancı ölçeği. *Educational Sciences & Practice, 1*(2), 197-210.

Blackbourn, J. M., Fillingim, J., Kritsonis, M. A., Campbell, J., Rader, D., Schillinger, D., & Ray, J. (2007). The road ahead: Ten trends that will impact education in this century. *National Forum of Educational Administration and Supervision Journal. 24*(3), 4-22.

Blasco, P. G., Moreto, G. Blasko, M. G., Levites, M. R., & Janaudis, M. A. (2015). Education through Movies: Improving teaching skills and fostering reflection among students and teachers. *Journal for Learning through the Arts. 11*(1), 1-16.

Buldur, S. (2017). A longitudinal investigation of the preservice science teachers' beliefs about science teaching during a science teacher training programme. *International Journal of Science Education*, *39*(1), 1-19.

Can, A. (2014*). SPSS ile bilimsel araştırma sürecinde nicel veri analizi*. Ankara: Pegem Akademi.

Capa, Y., Cakiroglu, J., & Sarikaya, H. (2005). The development and validation of a Turkish version of teachers' sense of efficacy scale. *Education and Science, 30*(137), 74-81.

Carr, W. (2006). Philosophy, methodology and action research. *Journal of Philosophy of Education*, *40*(4), 421-435.

Chambers, D. W. (1983). Stereotypic images of the scientist: The Draw a Scientist Test. *Science Education*, *67*(2), 255-265.

Choi, J. S., & Song, J. (1996). Students' preferences for different contexts for learning science. *Research in Science Education, 26*(3), 341-352.

Coban, A., & Sanalan, V. A. (2002). Fen bilgisi öğretimi dersinde özgün deney tasarım sürecinin öğretmen adayının öz yeterlilik algısına etkisi. *Erzincan University Journal of Education Faculty, 4*(2), 1-10.

Coladarci, T., & Donaldson Jr, G. A. (1991). School climate assessment encourages collaboration. *NASSP Bulletin*, *75*(536), 111-119.

Doymus, K., Simsek, U., & Bayrakceken, S. (2004). İşbirlikçi öğrenme yönteminin fen bilgisi dersinde akademik başarı ve tutuma etkisi. *Journal of Turkish Science Education*, *1*(2), 103-115.

Duban, N. Y. (2013). Pre-service science and technology teachers' mental images of science teaching. *Eurasian Journal of Educational Research*, *50*, 107-126.

Egyed, C. J., & Short, R. J. (2006). Teacher self-efficacy, burnout, experience and decision to refer a disruptive student. *School Psychology International*, *27*(4), 462-474.

Ekici, G. (2008). Sınıf yönetimi dersinin öğretmen adaylarının öğretmen öz-yeterlik algı düzeyine etkisi. *Hacettepe University Journal of Education*, *35*, 98-110.

Elmas, R., Demirdogen, B., & Geban, O. (2011). Preservice chemistry teachers' images about science teaching in their future classrooms. *Hacettepe University Journal of Education*, *40*, 164-175.

Elmas, R., & Eryilmaz, A. (2015). How to write good quality contextual science questions: criteria and myths. *Journal of Theoretical Educational Science*, *8*(4), 564-580.

Enochs, L. G., & Riggs, I. M. (1990). Further development of an elementary science teaching efficacy belief instrument: A preservice elementary scale. *School Science and Mathematics*, *90*(8), 694-706.

Evertson, C. M., Emmer, E. T., Sanford, J. P., & Clements, B. S. (1983). Improving classroom management: An experiment in elementary school classrooms. *The Elementary School Journal*, *84*(2), 173-188.

Finson, K. D., Beaver, J. B., & Cramond, B. L. (1995). Development and field test of a checklist for the Draw A Scientist Test. *School Science and Mathematics*, *95*(4), 195-205.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2011). *How to design and evaluate research in education*. New York: McGraw-Hill Humanities/Social Sciences/Languages.

Gable, R. A., Hester, P. H., Rock, M. L., & Hughes, K. G. (2009). Back to basics: Rules, praise, ignoring, and reprimands revisited. *Intervention in School and Clinic*, *44*(4), 195-205.

Grant, P. A. (2002). Using popular films to challenge preservice teachers' beliefs about teaching in urban schools. *Urban Education*, *37*(1), 77-95.

Guven Yildirim, E. (2015). Science Teacher Candidates' Portraits of Science Teaching as a Profession by Using the Characters in the Movie" 3 Idiots". *Educational Sciences: Theory and Practice*, *15*(5), 1363-1372.

Henson, R. K. (2001). *Relationships between preservice teachers' self-efficacy, task analysis, and classroom management beliefs*. Paper presented at the annual meeting of the Southwest Educational Research Association, New Orleans, LA.

Hoy, A. W., & Spero, R. B. (2005). Changes in teacher efficacy during the early years of teaching: A comparison of four measures. *Teaching and Teacher Education, 21*(4), 343-356.

Karasar, N. (2004). *Bilimsel araştırma yöntemi.* Ankara: Nobel Yayın Dağıtım.

Karatas, K., Ardic, T., & Oral, B. (2017). Öğretmenlik mesleğinin yeterlikleri ve geleceği: Metaforik bir analiz. *Turkish Studies, 12*(33), 291-312.

Kaskaya, A., Unlu, I., Akar, M. S., & Ozturan, M. S. (2011). The effect of school and teacher themed movies on pre-service teachers' professional attitudes and perceived self-efficacy. *Educational Sciences: Theory & Practice, 11*(4), 1778-1783.

Kiremit, H. O., & Gokler, İ. (2010). Fen bilgisi öğretmenliği öğrencilerinin biyoloji öğretimi ile ilgili öz-yeterlik inançlarının karşılaştırılması. *Pamukkale University Journal of Education, 27*, 41-54.

Kucuk, M., Altun, E., & Palic, G. (2013). Sınıf öğretmenlerinin fen öğretimi öz-yeterlik inançlarının incelenmesi: Rize ili örneklemi. *Amasya Education Journal, 2*(1), 45-70.

Lafferty, G. (2016). Opening the learning process: The potential role of feature film in teaching employment relations. *Australian Journal of Adult Learning*, *56*(1), 8-28.

Marri, A. R., Ahn, M., Fletcher, J., Heng, T. T., & Hatch, T. (2012). Self-efficacy of US high school teachers teaching the federal budget, national debt and budget deficit: a mixed-methods case study. *Citizenship, Social and Economics Education*, *11*(2), 105-120.

Michel, E., & Roebers, C. M. (2008). Children's knowledge acquisition through film: Influence of programme characteristics. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, *22*(9), 1228-1244.

Michel, E., Roebers, C. M., & Schneider, W. (2007). Educational films in the classroom: Increasing the benefit. *Learning and Instruction*, *17*(2), 172-183.

Morgil, İ., Secken, N., & Yucel, A. S. (2004). Kimya öğretmen adaylarının öz-yeterlik inançlarının bazı değişkenler açısından incelenmesi. *Journal of Balikesir University Institute of Science and Technology*, *6*(1), 62-72.

Okutan, M., & Kahveci, A. (2012). İlköğretim okul müdürlerinin genel öz yeterlik inançlarının çeşitli değişkenler açısından incelenmesi (Rize örneği). *Kastamonu Education Journal*, *20*(1), 27-42.

Ozerkan, E. (2007). *Öğretmenlerin öz-yeterlik algıları ile öğrencilerin sosyal bilgiler benlik kavramları arasındaki ilişki* (Master's thesis). Sosyal Bilimler Enstitüsü. Trakya Üniversitesi.

Pekdag, B. (2010). Alternative methods in learning chemistry: Learning with animation, simulation, video and multimedia. *Journal of Turkish Science Education*, *7*(2), 111-118.

Polat, S., & Akcan, E. (2017). Eğitim temalı filmlerin çokkültürlü eğitim açısından analizi. *Turkish Studies*, *12*(18), 475-504.

Roberts, J. K., & Henson, R. K. (2001). A confirmatory factor analysis of a new measure of teacher efficacy: Ohio State Teacher Efficacy Scale. Paper presented at the annual meeting of the American Educational Research Association, Seattle.

(ERIC Number: ED453254), retrieved from https://files.eric.ed.gov/fulltext/ED453254.pdf.

Ruble, L. A., Usher, E. L., & McGrew, J. H. (2011). Preliminary investigation of the sources of self-efficacy among teachers of students with autism. *Focus on Autism and Other Developmental Disabilities, 26*(2), 67-74.

Sahin, M., & Ozbay, Y. (1999). Üniversite öğrencilerinin empatik sınıf atmosferine ilişkin algılamaları. *Hacettepe University Journal of Education, 15*, 74-83.

Savran, A., & Cakiroglu, J. (2003). Differences between elementary and secondary preservice science teachers' perceived efficacy beliefs and their classroom management beliefs. *Turkish Online Journal of Educational Technology, 2*(4), 15-20.

Shechtman, Z., & Leichtentritt, J. (2004). Affective teaching: a method to enhance classroom management. *European Journal of Teacher Education, 27*(3), 323-333.

Tatar, N. (2015). Pre-service teachers' beliefs about the image of a science teacher and science teaching. *Journal of Baltic Science Education, 14*(1), 34-44.

Tekkaya, C., Cakıroglu, J., & Ozkan, O. (2002). A case study on science teacher trainees. *Education and Science, 27*(126), 15-21.

Thomas, J. A., & Pedersen, J. (1998). Draw-A-Science-Teacher-Test: A visualization of beliefs and self-efficacy. Paper presented in *the Annual Meeting of Association for Science Teacher Education*, Minneapolis.

Thomas, J. A., Pedersen, J. E., & Finson, K. (2001). Validating the Draw-A-Science-Teacher-Test-Checklist (DASTT-C): Exploring mental models and teacher beliefs. *Journal of Science Teacher Education, 12*(4), 295- 310.

Tschannen-Moran, M., & Hoy, A. W. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education, 17*(7), 783-805.

Turnuklu, A., & Yildiz, V. (2002). Öğretmenlerin öğrencilerin istenmeyen davranışlarıyla başa çıkma stratejileri. *The Journal of Contemporary Education, 284*, 22-27.

Usher, E. L., & Pajares, F. (2008). Sources of self-efficacy in school: Critical review of the literature and future directions. *Review of Educational Research, 78*(4), 751-796.

Woolfolk, A. E., & Hoy, W. K. (1990). Prospective teachers' sense of efficacy and beliefs about control. *Journal of Educational Psychology, 82*(1), 81–91.

Woolfolk, A. E., Rosoff, B. & Hoy, W. K. (1990). Teacher's sense of efficacy and their beliefs about managing students. *Teaching and Teacher Education, 6*(2), 137–148.

Yakar, H. G. I. (2013). Sinema filmlerinin eğitim amaçli kullanimi: Tarihsel bir değerlendirme. *HAYEF Journal of Education, 10*(1), 21-36.

Yaman, S., Koray, O. C., & Altuncekic, A. (2004). Fen bilgisi öğretmen adaylarının öz-yeterlik inanç düzeylerinin incelenmesi üzerine bir araştırma. *The Journal of Turkish Educational Sciences, 2*(3), 355-364.

Yildirim, E. G., & Koklukaya, A. N. (2017). Öğretmenlik mesleğine yönelik hazırbulunuşluk ölçeğinin geliştirilmesi ve fen bilgisi öğretmen adaylarının

hazırbulunuşluk düzeylerinin belirlenmesi. *International Journal of Social Science. 56*, 67-82.

Yildirim, E. G., Koklukaya, A. N., & Selvi, M. (2015). Öğretim materyali olarak 3-Idiot filmi ile öğretmen adaylarının günlük hayatta fenin kullanımı ve eğitimde aile rolü üzerine görüşlerinin belirlenmesi. *Trakya University Journal of Education, 5*(2), 94-105.

Yilmaz, H., Turkmen, H., Pedersen, J. E., & Huyuguzel-Cavas, P. (2007). Evaluation of pre-service teachers' images of science teaching in Turkey. *Asia-Pacific Forum on Science Learning and Teaching, 8*(1), 1-20.

Yurdigul, A. (2014). Eğitim olgusunun sinematografik anlatıdaki yeri üzerine bir yaklaşım denemesi: Bal filmi örneği. *Ekev Akademi Dergisi, 60*, 487-502.

Zee, M., & Koomen, H. M. (2016). Teacher self-efficacy and its effects on classroom processes, student academic adjustment, and teacher well-being: A synthesis of 40 years of research. *Review of Educational Research, 86*(4), 981-1015.

Journal of Theoretical Educational Science, 12(4), 1340-1364, October 2019
Kuramsal Eğitimbilim Dergisi, 12(4), 1340-1364, Ekim 2019
[Online]: https://dergipark.org.tr/akukeg
DOI number: http://dx.doi.org/10.30831/akukeg.501817

An Overview of Language Assessment Literacy Research within English Language Education Context

İngiliz Dili Eğitimi Bağlamında Yabancı Dilde Ölçme-Değerlendirme Okuryazarlığı Araştırmalarına Genel Bir Bakış

Aylin SEVİMEL-SAHİN[*] **Gonca SUBASI**[**]

Received: 24 December 2018 **Review Article** **Accepted:** 11 September 2019

ABSTRACT: Language assessment literacy (LAL) is the indication of language teachers' familiarity with assessment processes and ability to perform successful assessment procedures in foreign language education. In recent years, its importance has increased due to the developments in foreign language teaching. The research into this concept has already begun to define and conceptualize it. However, empirical research on LAL, especially about educational contexts, has not been much widespread. So, this systematic review mainly aims to present an overview of LAL concept within the scope of foreign language education. In particular, this review firstly illustrates its conceptual side by exemplifying the definitions, components and characteristics. Then, focusing on English language teachers, it evaluates the most up-to-date empirical studies conducted in EFL in-service or pre-service teaching contexts to show its place in foreign language assessment and the recent trends in LAL research. Lastly, it discusses the findings to suggest implications for practice and further study about LAL.

Keywords: language assessment literacy, foreign language education, English language teaching, foreign language assessment.

ÖZ: Yabancı dilde ölçme-değerlendirme okuryazarlığı, dil öğretmenlerinin ölçme-değerlendirme süreçlerine aşina olmasının ve yabancı dil eğitiminde başarılı ölçme-değerlendirme yöntemlerini uygulama becerisinin bir göstergesidir. Son yıllarda yabancı dil öğretimindeki gelişmeler nedeniyle bu kavramın önemi artmıştır. Bu kavrama yönelik yapılan araştırmalar, onu tanımlamaya ve kavramsallaştırmaya çoktan başlamış bulunmaktadır. Bununla birlikte, özellikle eğitim bağlamında yabancı dilde ölçme-değerlendirme okuryazarlığı üzerine yapılan ampirik çalışmalar çok yaygın değildir. Dolayısıyla, bu sistematik derlemenin temel amacı, yabancı dil eğitimi kapsamında yabancı dilde ölçme-değerlendirme okuryazarlığı kavramının genel bir değerlendirmesini sunmaktır. Özellikle, bu derleme öncelikle bu kavramın tanımları, bileşenleri ve karakteristik özelliklerini örneklendirerek onun kavramsal yanlarını göstermektedir. Sonrasında bu derleme, İngilizce öğretmenlerine odaklanarak kavramın yabancı dilde ölçme-değerlendirmedeki yerini ve bu kavrama bağlı güncel araştırma eğilimlerini ortaya koymak için hizmet içi ve hizmet öncesi öğretmenlik bağlamlarında gerçekleştirilen en güncel ampirik araştırmaları değerlendirmektedir. Son olarak, bu derleme, söz konusu kavramın uygulama alanları ve onun hakkında daha çok araştırma önerilerinde bulunmak için bulguları tartışmaktadır.

Anahtar kelimeler: yabancı dilde ölçme-değerlendirme okuryazarlığı, yabancı dil eğitimi, İngiliz dili eğitimi, yabancı dil değerlendirmesi.

[*] *Corresponding Author*: Res. Asst. Dr., Anadolu University, Eskisehir, Turkey, aylinsevimel@anadolu.edu.tr, https://orcid.org/0000-0003-2279-510X
[**] Asst. Prof. Dr., Anadolu University, Eskisehir, Turkey, goncas@anadolu.edu.tr, https://orcid.org/0000-0001-7049-5940

Citation Information:
Sevimel-Sahin, A., & Subasi, G. (2019). An overview of language assessment literacy research within English language education context. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 12*(4), 1340-1364.

ISSN: 1308-1659

Introduction

Teaching and assessment are considered to be two interrelated components in an educational context. In other words, assessment is acknowledged to be an essential part of instruction because it gives feedback about the quality of teaching. Therefore, assessment is helpful to reveal whether teaching is useful or not, whether students learn the targeted behaviors/knowledge/skills, and the extent the objectives of a course is achieved, and so on (Herrera & Macias, 2015; Rogier, 2014). Correspondingly, teachers make decisions about content, materials, alternatives, and the like in order for better and effective teaching practices and instruction (Rea-Dickins, 2004). So, since assessment gives information about teaching, it simply guides, regulates and reinforces teaching. As a result, students are motivated to learn, and both teachers' and students' performances are improved. Therefore, it can be asserted that teachers have dual roles: being an instructor, and at the same time, an assessor (Inbar-Lourie, 2013a; Wach, 2012). However, to be a proper assessor is a difficult characteristic because it entails both teachers' applying assessment practices according to their teaching environment and teaching knowledge, and developing the understanding of the nature of assessment (Scarino, 2013). Moreover, when the component of language itself is added to this difficulty, it is even more complex for teachers to be a good assessor. Therefore, it can be argued that language teachers have three main responsibilities: being proficient in a foreign language, having the necessary knowledge and skills in language teaching pedagogy, and being able to assess students' language progress in order to make decisions about the teaching/learning process. Out of these, language assessment becomes prominent because it guides teachers how to make decisions about the learning/teaching process (Oz & Atay, 2017). To carry out an effective assessment process, language teachers must possess a certain qualification as a part of their professional competence; namely, language assessment literacy (LAL).

LAL basically refers to the familiarity with the processes or procedures of language assessment. That is, teachers' ability to utilize effectively their knowledge of assessment in their teaching practices. In this sense, they are expected to have the knowledge and skills of assessment procedures such as how to design a testing task, what the suitable language measurement tools are, how to administer them, how to interpret the results to improve teaching/learning, and how to identify the needs of language learners. They are also expected to know what the approaches and recent trends in assessment are, how to relate that knowledge into their own practice, what the main principles of testing and assessment are, and how to evaluate a course entirely regarding students, teachers themselves, teachers' own teaching, inputs and outputs of the instruction. In order to have such features, language teachers must be assessment literate.

Recently, LAL has gained much importance because there has been a shift from traditional testing notion (summative evaluation) to current assessment concept (formative assessment) as well as a change in the approaches of language teaching methodology and the expectations about the education worldwide (Tsagari &Vogt, 2017). Therefore, as emphasized, language teachers must employ various assessment procedures that are suitable for their foreign language teaching context in order to keep up with modern world's needs of foreign language education. Moreover, LAL is seen as the link between the quality of assessment and the achievement of students (Bayat &

Rezaei, 2015). Though there have been notable studies into LAL lately, the research into this field can be said to be too new and scarce (Fulcher, 2012). So, researchers need to study on this concept from different perspectives in order to enlighten and provide insights into this issue more.

In response to this need, the purpose of the current systematic review is to present an overview of what is known, what has been studied, what the missing parts are, and what the implications for language education might be about LAL within English language teaching/learning context.

Literature Review

Language Assessment Literacy (LAL): The Conceptual Framework

There has been an increasing attention to demonstrate the role of assessment in language teaching by means of investigating language assessment theory and practice. As Inbar-Lourie (2017) has argued, there have been changes in the approach of language assessment towards a more formative understanding accompanied by the developments occurred in the pedagogy of language teaching. In the same vein, there has been an expansion of standardized language testing around the world and some countries use language tests as their national policy (Fulcher, 2012). Furthermore, as in the change of language assessment notion towards formative assessment, there has been a shift to more sociocultural theories of learning framed within zone of proximal development and dynamic assessment in language teaching methodologies (Fulcher, 2012; Inbar-Lourie, 2008; Scarino, 2013). Thus, the consequences of all such changes have led to modifications in language assessment conceptions. It can be inferred that the responsibilities of language teachers have increased due to the fact that the importance of language assessment has been recognized.

The importance of LAL concept has been emphasized in research studies conducted in assessment field because this concept is considered to meet the needs of being competent language educators in the field of testing, assessment and evaluation as well as being an effective instructor in language teaching process (Buyukkarci, 2016). In this respect, theories and practices of language assessment have obtained a crucial role in language teaching/learning while helping teachers to develop their own LAL competencies. Therefore, most researchers have studied LAL to define, to construct its frameworks, to determine the characteristics of language teachers that have LAL, and to underline its significance within foreign language education. In this respect, there have been a number of review or conceptual articles related to LAL over the last years compared to empirical research studies, especially within foreign language learning/teaching contexts.

As far as this issue is taken into account, the current review firstly presents what is done in LAL research by discussing its meaning and background, and then, evaluates the empirical research studies carried out with English language teachers as to display its place in the field of language assessment.

Definitions of LAL. The basis of LAL dates back to 1990s when Stiggins (1995) first coined the term assessment literacy (AL) in general education. He defined AL as teachers' own understanding of assessment knowledge and procedures and the

influence of such knowledge in their practices. After that, the content of AL in education was formed in line with the increasing role of formative assessment in education. However, the content was not sufficient to appeal to specific teaching subject areas such as mathematics, science and language arts. Thereupon, researchers began to investigate AL from the perspective of different subject areas. Since foreign language teachers have a specific competency, which is language proficiency, content pedagogical knowledge of language teaching differs from other subjects. This difference makes language assessment distinctive from teacher general assessment literacy because both the teaching context and target learner group are different. So, language assessment requires peculiar features in its own sense including how to assess language skills such as speaking, writing, listening and reading, and language areas such as grammar, vocabulary and pronunciation within the scope of culturally situated language teaching environments. Therefore, the necessity of being language assessment literate to fulfill the needs of language teaching has been highly emphasized in the literature.

Basically, LAL refers to the familiarity with assessment procedures of the stakeholders concerned in this process such as teachers (testers), students (testees), administrators and other staff in education. However, as in language teaching/learning process, the most central stakeholder is language teachers (Giraldo, 2018; Rea-Dickins, 2004). Thus, teachers have the responsibility of assessing their language learners most of the time except for large-scale standardized tests that require experts of test-designers. Based on this view, most researchers have defined LAL from the perspective of language teachers. Therefore, sometimes LAL is referred as language teacher assessment literacy (LTAL).

Davies (2008) is among the researchers who first tried to define the concept of LAL and determine its components. According to his definition, LAL requires three types of features: the knowledge of language, context, and measurement; training in assessment skills and methodology like item writing and statistics; and the principles of language assessment like ethics and impact. Likewise, Inbar-Lourie (2008) has presented that LAL is "to have capacity to ask and answer critical questions about the purpose of assessment, about the fitness of the tool being used, about testing conditions, and about what is going to happen on the basis of the results" (p. 389). She has also indicated that LAL includes "the understanding the 'what' and performing the 'how' necessitates appreciation of the background and reasoning behind the actions taken, that is, 'why'" (Inbar-Lourie, 2008, p. 390). So, the questions of what, how and why lead to the construction of LAL meaning. Besides, Taylor (2009) has stated that LAL means understanding the language assessment principles, being able to put these principles into practice, selecting or developing appropriate assessment tasks, collecting assessment data to interpret and evaluate the process, and making decisions about pedagogical process. Similarly, LAL refers to the knowledge, principles and skills of language assessment procedures inclusive of developing language test items, administering them, interpreting test scores, evaluating the whole language learning/teaching process, and the functions of assessment in a broader sense (Lam, 2014; Pill & Harding, 2013). By drawing attention to the relationship between theory and practice of language assessment, Vogt and Tsagari (2014) have defined LAL as "the ability to design, develop, and critically evaluate tests and other assessment procedures, as well as the

ability to monitor, evaluate, grade and score assessments on the basis of theoretical knowledge" (p. 377). On other hand, Fulcher (2012) studied on the learning needs of in-service language teachers in assessment by developing a survey instrument. He focused on knowledge, skills, principles and concepts of language assessment by adding another dimension called contexts that involve historical, social, political and philosophical frameworks to make sense of language assessment itself and its effect on society. Considering these, he provides an expanded definition of LAL as:

> The knowledge, skills and abilities required to design, develop, maintain or evaluate, large-scale standardized and/or classroom-based tests, familiarity with test processes, and awareness of principles and concepts that guide and underpin practice, including ethics and codes of practice. The ability to place knowledge, skills, processes, principles and concepts within wider historical, social, political and philosophical frameworks in order to understand why practices have arisen as they have, and to evaluate the role and impact of testing on society, institutions, and individuals (Fulcher, 2012, p. 125).

This is now accepted as the most comprehensive definition of LAL in the literature. However, Giraldo Aristizabal (2018) has underscored the view that LAL must comprise not only large-scale (standardized) but also small-scale (classroom-based) language assessment knowledge and skills in addition to the appropriate use of assessment ethically and in a fair way.

To sum up, the definitions of LAL given to date have more or less highlighted the main elements such as teachers' knowledge, skills, principles, contexts, procedures and understanding of language assessment within the scope of language teaching education.

Components or dimensions of LAL. Researchers who are interested in the field of LAL have illustrated its components or dimensions in relation to their definitions. That is, they have tried to demonstrate what this concept constitutes by developing frameworks or conceptualizations. For example, Davies (2008) has discussed that LAL has three components: knowledge, skills, and principles. Knowledge of language assessment entails the knowledge of language description, context and measurement. Skills encompass practices of assessment such as designing language tests and interpreting results. Principles involve using appropriate tests, fairness and washback effect of assessment. Inbar-Lourie (2008; 2013b) has also approached LAL concept by three questions in order to classify the dimensions of LAL: what, how, why. 'What' reflects the content or behavior or learning outcome about language learning to be assessed; 'how' refers to the assessment procedures, tools, analysis and the like; 'why' includes the rationale or framework behind language assessment. Out of these dimensions, 'what' is prominent because it directly reflects the context of language teaching. Besides, Scarino (2013) has divided LAL into two categories: knowledge base and process base. Knowledge base means identifying disciplinary domains within language context boundaries so as to show how to develop and use the knowledge in practice. Process base refers to the developing phase that teachers construct their own concepts through their critical approaches towards language assessment. As for Fulcher (2012), as in his definition, he has concluded that LAL has three layers: practices at the bottom layer, principles in the middle layer and contexts at the top layer. Practices consist of knowledge, skills and abilities related to language assessment. Principles are the processes, principles and concepts of language

assessment. Contexts are made up of historical, social, political and philosophical frameworks that question the origins, reasons and impacts of language assessment. Fulcher (2012) has also underlined the fact that this type of dimensional LAL may not fit to other stakeholders except for teachers. In order to summarize all the models of LAL, Stabler-Havener (2018) presents an outline of LAL components in which she has proposed four models. The first one is 'A Five-Component, Professional Development Program Model' which uses certain standards to identify AL components. Inspired by this model, she has argued that Inbar-Lourie's (2008) 'what, how, why' dimensions reflect those standards. The second one is 'A Skills, Knowledge and Principles Model' that is attributed to Davies' (2008) LAL components. The third one is 'A Practices, Principles and Contexts Model' which refers to Fulcher's (2012) expanded definition of LAL. The last one is 'A LAL Stakeholder Profile Model' that takes into account other stakeholders in addition to teachers as supported by Pill and Harding (2013), and Taylor (2013). For instance, Taylor (2013) has divided stakeholder constituents into three layers: core, intermediary and peripheral. In the peripheral layer, there are policy makers and general public. In the intermediary layer, language teachers and course instructors are found. In the core layer, test makers and researchers take place. According to their own layer type, the extent of dimension about knowledge and other related topics about language assessment change. For classroom teachers, language pedagogy is more important than other constituents in language assessment procedure (see Taylor, 2013, Figure 2, p. 410 for more information).

To conclude, LAL shares relatively the same components or dimensions with different categorical names such as knowledge, process, skills, principles, abilities and contexts.

Characteristics or competencies of LAL. Researchers or area experts in language assessment/education have drawn conclusions to characterize what the features of LAL are and what kind of competencies reflect teachers' LAL development. In this sense, the first steps were taken by the American Federation of Teachers, National Council on Measurement in Education and National Education Association in 1990 by suggesting seven principles for teacher AL under the name 'The Standards for Teacher Competence in the Educational Assessment of Students' (Mertler, 2003). In fact, The Standards were generated before the term AL that did not exist until Stiggins mentioned in 1995 But The Standards have been accepted to reflect what the competencies of teachers with regard to assessment are in terms of general education, which have been used to describe teacher assessment literacy competencies. The principles proposed cover the following characteristics:

> 1. choosing appropriate assessment methods; 2. developing appropriate assessment methods; 3. administering, scoring, and interpreting the results of assessments; 4. using assessment results to make decisions; 5. developing valid grading procedures; 6. communicating assessment results; 7. recognizing unethical or illegal practices (Mertler, 2003, pp. 8-9).

Stiggins (1995) has also pointed out that assessment literates know and realize what sound and unsound assessment is. That is, all assessment literate stakeholders know what they assess, how to assess, why they assess and how to use assessment results effectively. Similarly, some researchers believe that not only classroom teachers but also other stakeholders in assessment process such as policy makers, test developers and learners themselves are important factors (Djoub, 2017; Pill & Harding, 2013;

Taylor, 2013). Hence, all such stakeholders need to be assessment literate in order for a better educational process. Nonetheless, teachers have still held the central role among other stakeholders in terms of language assessment (Giraldo, 2018).

Most researchers have identified the competencies of assessment literate teachers nearly the same regardless of any specific teaching subject area (Berry & O'Sullivan, 2016; Gotch & French, 2014; Huang & He, 2016; Khadijeh & Amir, 2015; Rogier, 2014). They have emphasized common characteristics of assessment literate teachers as understanding what a good assessment is, knowledge of how to assess with which tools according to appropriate learning goals, interpreting assessment results in order to make decisions about teaching as well as to enhance learning, being able to analyze one's own assessment practices, integrating suitable assessment procedures into learning/teaching context effectively, being familiar with alternatives in assessment, and applying assessment procedures ethically. Nevertheless, such characteristics reflect only general competencies of assessment literate teachers. To highlight the factor of language, Inbar-Lourie (2013b) has postulated that language assessment literate teachers must have additional characteristics such as proficiency in language classroom assessment, mastering language acquisition and learning theories and modifying them accordingly to their assessment practices, considering authentic language use and being aware of assessment dilemmas. She has also indicated that all these characteristics are individualized within teachers' own language teaching context. In another research, Inbar-Lourie (2017) has exemplified the importance of language in LAL by means of the Common European Framework of Reference (CEFR). CEFR integrates teaching and assessment in language education, and thus, has recommended alternative forms of language assessment such as portfolio and self-assessment. Therefore, in a way, CEFR can be assumed to contribute to LAL.

Likewise, Giraldo (2018) has supported the claim that language component should be underlined while discussing the competencies of language assessment literate teachers because language itself - its knowledge, use, and pedagogy- differentiates LAL from general AL characteristics. He has constructed a comprehensive list of LAL characteristics by expanding Davies' (2008) components of LAL, and he has suggested a total of sixty-six features considering three-dimensional structure of LAL as knowledge, skills and principles (see Giraldo, 2018, Table.1, p. 188 for more information). He has tried to emphasize the element of language nearly in all sub-competencies of language assessment literate teachers in his list. Therefore, it can be inferred that Giraldo (2018) has presented a comprehensive and detailed list of LAL characteristics.

As a conclusion, it is apparent that characteristics of assessment literate teachers are relatively common. But it should be noted that other categories highlighting the component of language have also been added in terms of language education thanks to the research conducted within the scope of LAL.

Purpose of the Review

LAL is considered to be an important element in foreign language education, and the research into this field has just commenced as Fulcher (2012) has asserted. There have been recent attempts to define this concept, to develop related framework, to identify the characteristics or to review the existing literature through mostly a

theoretical or conceptual point of view (e.g. Inbar-Lourie, 2013a; Popham, 2009; Rogier, 2014; Taylor, 2009). Yet, there are few empirical research studies investigating this concept from the perspective of teaching context (in-service vs pre-service) in the literature. Therefore, the major concern of this systematic review is to provide an overview of the research studies conducted with in-service and pre-service English language teachers in the context of foreign countries where English language is taught as a foreign language. To explore recent trends in LAL within the scope of context can shed light on what is known, what is done, what needs to be done to improve, what the gaps or challenges are, how the concept is practiced in classrooms and what can be recommended as implications in education regarding the concept of LAL.

All in all, the current systematic review firstly aims to introduce the concept of LAL by discussing its definitions, characteristics, components and importance in foreign language education by means of the studies conducted in the section 'LAL: The Conceptual Framework'. Then, specifically, this article focuses on the research studies carried out in EFL contexts both with in-service and pre-service teachers between 2014-January and 2018-June (the last five years) in order to present a review of current state of LAL in such contexts at the teacher level by showing not only conceptual but also practical side of LAL. Lastly, this paper has the purpose of summarizing and synthesizing the most up-to-date research on LAL within foreign language education so as to provide insights into future directions and implications for further study.

Method

The present study employs systematic review as the research methodology. It is because it aims to explore the concept of LAL within English language teaching contexts including both in-service and pre-service educational environments in order to determine the current place of LAL within these contexts, and also to make implications for future studies.

Systematic review basically refers to review relevant literature in a particular field of study in a systematic process as comprehensive as possible to make meaning of information and contribution to the addressed questions or problems (Petticrew & Roberts, 2006). It is based on a specific problem or question to review the related literature systematically rather than just summarizing it (Petticrew & Roberts, 2006). It should be noted that although systematic review is used interchangeably with the terms research synthesis or research review and sometimes with meta-analysis or meta-synthesis, there is not a general agreement how they are different (Copper, Hedges, & Valentine, 2010).

Systematic review is mostly utilized "when a general overall picture of the evidence in a topic area is needed to direct future research efforts" (Petticrew & Roberts, 2006, p. 21) including quantitative, qualitative or any other eligible research studies as in the present study; and thus, it does not have to be only quantitative (as in meta-analysis) or qualitative (as in meta-synthesis) research. Its systematicity comes from the procedure used as a step-by-step process to review the literature and accordingly, to provide an overview by means of synthesizing the studies to enlighten the addressed topic. According to Petticrew and Roberts (2006), systematic review includes the steps of formulating question, problem, hypothesis or topic needed to be searched, determining the eligibility criteria as inclusion and exclusion criteria,

literature search through databases, and synthesizing evidence by means of narrative synthesis. In narrative synthesis, the organization and description of studies, the analysis of the findings, and the synthesis of the findings are carried out (Petticrew & Roberts, 2006). Therefore, certain steps were performed while organizing the content of this systematic review.

The Procedure of the Present Systematic Review

This systematic review utilizes some steps to review the relevant literature in line with the study purpose considering Petticrew and Roberts' (2006) proposed process.

First of all, the relevant research about language assessment literacy was investigated. To do so, certain well-known electronic databases specifically about education (ERIC, EBSCO and Google Scholar) were utilized. It should be noted that ERIC was a part of EBSCO while searching. Additionally, a national database called DergiPark/ULAKBIM, a Turkish database, was included because some articles could not be found via mentioned databases though Turkey has an EFL context.

Secondly, the keyword "language assessment literacy" was used with and without quotation marks to do the preliminary search. That keyword was applied to all sections such as abstract, keywords, content and title of the studies.

In the third step, some criteria (inclusion and exclusion criteria) were employed according to the purpose of this study to determine and choose relevant research studies. Those criteria could be specified as: Only accessible studies that were written in English language were considered. The category of education was selected. The most recent research about LAL was determined by putting check between the years 2014-January and 2018-June so that last 5 years of research would appear. Only peer-reviewed empirical articles were taken into consideration because one of the aims of this review was to show the place of LAL within practice. Therefore, books, book chapters, book reviews, reviews of literature, theoretical/review articles, conference papers and proceedings, theses/dissertations were excluded. Besides, topic relevancy (language assessment literacy) was concerned; that is, the studies with reading and writing skills used to describe merely literacy without assessment focus were not thought for this review. The articles of only teacher focused LAL were included since EFL teachers are the main stakeholders of language assessment, and teachers' background contexts were taken into account as pre-service and in-service teaching contexts. It should be underlined that only English subject matter as a foreign language was considered. All types of research designs such as qualitative, quantitative and mixed-methods designs were welcomed. Overlapping articles within the databases were also removed.

As a fourth step, the organization and exclusion of articles were carried out by two authors of this study. Accordingly, the articles which suited to the criteria (only English language based, teacher-focused, empirical, not review, consisting of pre-service and in-service teaching contexts, the most up-to-date) were selected and examined according to the determined eligibility criteria. In the first search, there were 758 articles regardless of the criteria (EBSCO: 135, ERIC: 34, Dergipark: 351; Google Scholar: 238); there were overlapping ones and some articles without the scope in this number, as well. After the elimination, the rest was 21 empirical research articles all of which were suitable to the selection criteria.

Finally, these suitable articles about EFL teachers' LAL within pre-service and in-service teaching contexts were evaluated in order to show the current state of LAL in ELT as well as to provide future directions about the topic by means of narrative synthesis under the themes in-service and pre-service EFL teaching contexts.

The Profile of the Research Articles Included

The research articles reviewed in this paper are made up of 21 empirical studies conducted in the last 5 years. The distribution of the articles across the publication years can be seen in Table 1. In the last two years, there has been an expansion of empirical articles within LAL research. Thereupon, it can be inferred that rather than writing only review or conceptual articles, researchers have begun to investigate LAL in practice. On the other hand, the studies conducted in in-service EFL context (*f*=17) outnumbered the studies in pre-service context (*f*=4). Therefore, there is a research gap in terms of the studies in pre-service EFL contexts where the development of LAL begins, so it is a critical stage.

Table 1

The Distribution of Research Articles across Publication Years (2014-January & 2018-June)

Year	EFL In-service Context		EFL Pre-service Context		*Total*
	Foreign*	Turkish	Foreign	Turkish	
2018	2	2	-	1	5
2017	5	2	-	-	7
2016	1	2	1	-	4
2015	2	-	-	1	3
2014	1	-	1	-	2
Total	11	6	2	2	
	17		4		21

**Foreign refers to the countries which have an EFL context other than Turkey such as China, Colombia and the like in order to show the comparison.*

As for the features of the articles, they were outlined in Table 2. When this table is scrutinized, it can be seen that most researchers have preferred qualitative research designs (*f*=12). It can be assumed that more different research designs may be complementary to enlighten the issue of LAL from different perspectives. In addition, more different research tools can be utilized because interviews and questionnaires/surveys were dominant.

Table 2

The Features of LAL Research Articles between 2014-January and 2018-June

	Author(s)/Year	Type	Context	Participants/Instruments
1	Giraldo Aristizabal (2018)	action research	in-service EFL (Colombia)	60 teachers questionnaire, interview, document
2	Yan, Zhang & Fan (2018)	qualitative	in-service EFL (China)	3 EFL teachers interview

3	H. Xu (2017)	longitudinal (3 years)	in-service EFL-novice (China)	4 novice teachers observation, interview, field notes, journal writing
4	Tsagari & Vogt (2017)	qualitative	in-service EFL (Cyprus, Germany, Greece)	63 teachers interview
5	Y. Xu & Brown (2017)	quantitative	in-service EFL (China)	891 teachers questionnaire, survey
6	Sellan (2017)	qualitative	in-service EFL (Singapore)	8 teachers documents, interview, stimulated recall, observation
7	Baker & Riches (2018)	qualitative	in-service EFL training (Haiti)	120 teachers feedback, critiques, survey, interview
8	Y. Xu (2016)	qualitative	in-service EFL (China)	20 teachers lesson plans, interviews
9	Hakim (2015)	quantitative	in-service EFL (Saudi Arabia)	30 instructors survey
10	Jannati (2015)	qualitative	in-service EFL (Iran)	18 instructors interview
11	Vogt & Tsagari (2014)	mixed	in-service EFL (EU countries)	7 countries questionnaire: 853 interview: 63
12	Yastibas & Takkac (2018a)	qualitative	in-service EFL (Turkey)	8 instructors think-aloud protocols
13	Yastibas & Takkac (2018b)	qualitative	in-service EFL (Turkey)	8 instructors interview, focus group
14	Mede & Atay (2017)	mixed	in-service EFL (Turkey)	350 instructors questionnaire, focus group
15	Oz & Atay (2017)	qualitative	in-service EFL (Turkey)	12 instructors interview
16	Tuzcu-Eken (2016)	qualitative	in-service EFL (Turkey)	5 teachers & 15 students interview
17	Buyukkarci (2016)	quantitative	in-service EFL (Turkey)	32 teachers survey
18	Viengasang (2016)	mixed	pre-service ELT (Thailand)	46 undergraduates at practicum survey, interview
19	Lam (2014)	qualitative	pre-service ELT (Hong Kong)	5 teacher education institutions program and government documents, interview, student assessment tasks, teaching evaluation

20	Komur (2018)	qualitative	pre-service ELT (Turkey)	49 undergraduates open-ended questions
21	Hatipoglu (2015)	mixed	pre-service ELT (Turkey)	124 undergraduates survey, interview

As a conclusion, there have been noteworthy attempts in the literature to investigate the concept of LAL within foreign language education contexts.

Findings

Empirical research articles about EFL teachers' LAL were analyzed in terms of their teaching contexts (in-service vs pre-service). It is because teaching context is considered to affect and shape all the assessment practices and knowledge of language teachers. The concept of context includes learners' characteristics and needs, teaching/learning goals, teachers' experience in assessment, teachers' own beliefs, resources, training phase and the like within foreign language education. Therefore, this review has divided findings into two sections: In-service context and pre-service context.

In-service EFL Context of LAL Research

This section of the present review is mainly about the recent studies carried out within in-service EFL context regarding LAL. Specifically, it illustrates what researchers have investigated in terms of EFL teachers' language assessment, whether EFL teachers who are working in schools or at universities are language assessment literate, what kind of variables have an impact on their LAL, and whether they need training on language assessment or not.

To begin with, Giraldo Aristizabal (2018) investigated the assessment beliefs and practices of English language instructors working at a language institute in Colombia while designing an achievement test. He carried out his research as a part of action research which aimed to develop LAL of in-service EFL teachers. 60 EFL teachers participated in the study. Since that part of the research was qualitative-oriented, questionnaires, interviews and documents were the primary data collection tools. The researcher used a priori coding system in order to analyze the data. The analysis yielded that the participant teachers believed tests should have basic qualities such as validity and reliability while they reported that not all qualities were reflected in the practices. They also indicated that designing a test as a part of their training was useful for their professional development.

Yan, Zhang, and Fan (2018), however, focused on contextual and experiential factors in the development of LAL. That is, they designed their study in order to evaluate how such factors interact with each other to enhance LAL. 3 EFL teachers from middle school in China were interviewed with five questions regarding their experiences in assessment practices in terms of their working context. The analysis was conducted through an inductive approach with five categories as assessment context, assessment training experience, assessment practice, assessment knowledge and assessment training needs. The findings revealed a separate LAL profile of teachers in which the effect of context was found. The participants also needed more training in

assessment practice rather than assessment knowledge. In this sense, the results showed that their theoretical knowledge was mostly formed through their practices and working contexts. Thus, teachers had fine opinions about assessment issues due to their practices.

In a similar vein, Xu (2017) explored the development of LAL of novice EFL teachers. He carried out a three-year-longitudinal study with 4 EFL teachers in China. He collected qualitative data with the help of different techniques such as classroom observation, interview, journal entries and fieldnotes. As a result of his analysis of 3-year-development, he found three stages: The first stage was learning and applying practical assessment techniques; the second stage was connecting assessment to teaching goals; the third stage was the transition from planned assessment to more improvised formative assessment. Those stages reflected the participants' progress in their language assessment practices. The researcher also emphasized that improvised assessment may be the sign of LAL development.

Tsagari and Vogt (2017) concentrated on the qualitative part of their study conducted across seven European countries in 2014 in order to discuss perceived levels of LAL as well as training needs of in-service EFL teachers. However, the researchers took only three countries; namely, Cyprus, Germany, and Greece, for that part of the study. Thus, they conducted interviews with 63 EFL teachers from primary or secondary school context. Teaching experience of the participants ranged from two to thirty-four years. The interview findings indicated that nearly all the teachers still utilized pen-and-paper tests and traditional assessment tasks but did not use standardized tests; they preferred classroom testing. Furthermore, teachers reported that they knew alternative assessment tools but did not use in their classroom practices. The participants also mentioned they received language assessment training but found it not very useful because their LAL seemed to improve during working professionally. However, they were not successful enough to determine what they need as assessment training or what they need to enhance their LAL levels. So, the researchers argued that the sample was not at a sufficient level in terms of LAL, which indicated that language assessment training in teacher education was not adequate. They also commented that language assessment practices of EFL teachers were not much developed.

Likewise, Xu and Brown (2017) intended to investigate EFL teachers' levels of LAL and the impact of demographic variables on their assessment performances. Therefore, they applied an adapted version of teacher assessment literacy questionnaire surveys consisting of assessment scenarios and also items related to demographic information. The sample was made up of 891 EFL teachers working at universities from seven regions of China. The results of the surveys revealed that demographic variables did not influence the levels of LAL, i.e. teaching experience did not affect assessment decisions or performances much. Besides, the levels of LAL were at the moderate level. Therefore, the researchers recommended that the concept of LAL and its measurement should be contextually grounded so that it can reflect the assessment contexts where teachers work.

Unlike other studies, Sellan (2017) focused on a new language assessment paradigm introduced in Singapore as a part of educational policy. That was Integrated Program which aimed to stimulate teacher-based classroom assessment practices to enhance language learning while delimitating traditional exams. Thus, the study was

based on EFL teachers' formative assessment and how such assessment was helpful in language learning. 8 high school EFL teachers were interviewed three times: in the beginning, in the middle, in the end. Lesson observations, policy documents and paper marking practices were also evaluated. The analysis of all the data collected yielded that EFL teachers not only improved in terms of language related issues such as knowledge, genre, culture and authenticity but also performed better assessment techniques in line with their expanded language improvement. In this way, teachers stated that they could more easily and successfully respond to the needs of language learners.

From the perspective of in-service training, Baker and Riches (2018) designed a one-week-workshop so as to improve the participants' levels of LAL in Haiti. Hence, they examined the development of LAL from the views of two stakeholders: EFL teachers and facilitators. 120 EFL teachers were working in high schools and did not take an assessment training before. During language assessment workshop, the researchers collected teachers' feedback on draft exams as well as their critiques of national exams. They also conducted surveys and interviews with the sample. They found that both types of participants developed positively in language assessment. However, they had challenges in decision-making phase while collaboratively studied with facilitators, but the researchers compromised with teachers more easily, which showed that teachers were more open to development.

On the other hand, Xu (2016) was motivated by the problem that was not much explored: how teachers planned their assessment practices. The findings for this problem would also show the development level of LAL. So, she run qualitative analyses of EFL teachers' lesson plans and additionally, conducted interviews with 20 university teachers in China. As a consequence of her analysis, it was found that teachers obviously added assessment components such as objectives in their plans but did not match learning objectives with their assessment practices. Teachers also did not utilize rubrics for performance assessment. The researcher concluded that EFL teachers' assessment was much more intuitive and governed by their instruction rather than clearly planned.

Considering the relationship between experience and assessment, Hakim (2015) explored the perceptions of EFL teachers in line with their experiences in assessment in order to reveal the level of awareness and ideology regarding LAL. She developed a questionnaire related to language assessment perceptions and 30 language instructors working in English Language Institute in Saudi Arabia responded. The questionnaire responses showed that the participants had the knowledge of assessment techniques and their use but were not able to put that knowledge into practice. Therefore, teaching experience did not affect their assessment practices, but affected only understanding of assessment components or testing plan.

In the same vein, Jannati (2015) focused on the perceptions and practices of in-service English language teachers about assessment. Her study included 18 English language instructors who were divided into three groups with regard to their teaching experience from low to highly experienced. The findings from interviews indicated that the instructors were familiar with general concepts and terminologies of assessment. Nevertheless, teaching experience did not influence instructors' perceptions of assessment. So, though they had the knowledge of assessment, which was their assessment literacy, they were not able to use that literacy in their teaching practices.

Pointing to training needs, Vogt and Tsagari (2014) investigated the levels of EFL teachers' LAL and whether they needed training in assessment across seven European countries (Cyprus, Macedonia, Germany, Greece, Italy, Poland, Turkey) by means of questionnaires. As mentioned in the previous parts, the researchers did the same study but divided it into two parts as qualitative in 2017 and quantitative in 2014. Consequently, that study was the quantitative part of their research. The researchers found that teachers needed training in language assessment though they were working professionally. It is because local needs of educational contexts were different, and their knowledge of assessment could not be adequate to assess language learners in practice. Therefore, the researchers highlighted that pre-service teacher education is important in providing a good model of language assessment training.

Considering Turkish in-service context, Yastibas and Takkac (2018a) were interested in how EFL instructors decided what to assess and how to assess. In this way, they aimed to show how teachers' LAL would be reflected in their practices. Therefore, they made 8 EFL instructors from a Turkish university prepare and design language tests for different language skills and areas. They utilized think-aloud protocols with which they tried to illustrate the process of planning assessment. The findings indicated that the participants prepared language tests according to the progress of their students and the material used as coursebook. Therefore, all the assessment was structured in line with students and coursebook. The sample also reported that language tests had a positive washback on students learning.

In another study, Yastibas and Takkac (2018b) investigated how EFL teachers developed their LAL while working as language instructors at university in Turkey. In their study, 8 EFL instructors were individually interviewed and also were included in focus group discussion about their language assessment conceptions and experiences. The researchers shaped the findings in three dimensions: previous assessment experience, assessment training and self-improvement. It was found that teachers' previous assessment experiences differed from each other, and thus, they held different beliefs and conceptions about language assessment, which reflected their assessment practices. Moreover, teachers' pre-service assessment training was much more influential in their development of LAL. Among those three dimensions, the most prominent one was found as self-improvement because the participants reported that while they had the chance to practice their assessment knowledge by preparing and administering assessment procedures, they gained experience, which led to an improvement in their LAL level. Hence, the researchers highlighted that language assessment experience was an important factor in the improvement of LAL.

Mede and Atay (2017) were also concerned with the levels of LAL of EFL teachers who were working at universities in Turkey. They designed their study to find out training needs in language assessment practices. They collected relevant data by means of a questionnaire and focus group interviews. 350 EFL instructors with more than five years of teaching experience took part in the study. The findings indicated that the whole sample needed training even in basic assessment techniques. The sample stated that they were not able to prepare good language tests and provide feedback according to the test results. They also mentioned that the construction of skill-based language tests was difficult for them; they were only good at preparing vocabulary and grammar tests. So, the researchers pointed out that the assessment training the sample

received was not sufficient because it did not improve language assessment practices except for grammar and vocabulary testing.

In addition, Oz and Atay (2017) focused on in-class language assessment perceptions of Turkish EFL instructors. They investigated teachers' reflections, knowledge, practices and experiences with respect to language assessment through their perceptions. 12 EFL instructors were interviewed and they expressed that they had much knowledge about language assessment. But it was problematic when teachers tried to apply that knowledge into their assessment skills, which indicated that LAL could not be reflected in classroom assessment well. Their teaching experience also was not very helpful in improving LAL in practice.

From a different point of view, Tuzcu-Eken (2016) addressed the problems of testing and obstacles encountered within vocational school context in the implementation of assessment. To investigate those issues, she conducted interviews with 5 Turkish EFL teachers about their views on testing and what kind of problems they came across while assessing language learners. She also put emphasis on students' opinions in the process; therefore, she carried out focus group interviews with 15 students. While students were found to have lack of motivation since their main goal was to pass the course, teachers reported that they tried their best to employ different language assessment techniques despite certain barriers. The problems mentioned comprised of physical conditions such as lack of technological tools, crowded classes and not administering listening and speaking assessments properly due to class size. Though teachers believed they were somewhat language assessment literate, they could not reflect their literacy into their contexts, which shows that external factors hindered applying appropriate and comprehensive language assessments.

Buyukkarci (2016), however, carried out his research in order to find out the levels of LAL of Turkish EFL teachers working in primary, secondary and tertiary education. He also explored whether teaching experience and post-graduate education led to a difference in teachers' LAL. 32 EFL teachers responded to a survey of assessment literacy. The results yielded low levels of LAL, which indicated that teachers' LAL did not improve much. Furthermore, both teaching experience and doing post-graduate education did not contribute to the development of the participants' LAL. All those results produced the interpretations that pre-service training, in-service teaching experience and post-graduate training were not really helpful in enhancing LAL; so, teachers needed satisfactory language assessment training.

Pre-service EFL Context of LAL Research

This section of the current review is based on the most up-to-date language assessment studies conducted with pre-service EFL teachers who would be teachers at the end of their teacher training. Essentially, it depicts language assessment training of prospective EFL teachers, to what extent they are language assessment literate, what kind of variables have an impact on their LAL during their teacher education, and whether the training was useful or not. By addressing those questions, the researchers have sought the ways to improve LAL of pre-service teachers. However, it should be noted that in recent years, there are not many studies interested in pre-service context compared to in-service context.

To start with, Viengsang (2016) carried out her study in order to investigate how assessment literacy was understood, the effect of previous training, and practices in the practicum, the needs and problems regarding assessment. She was concerned with pre-service language assessment training context, and hence, 46 EFL teacher candidates doing their teaching practice in Thailand took part in the study. The sample firstly responded to a questionnaire and then, 5 of them were interviewed. The results showed that though the sample was trained, and had the knowledge of language assessment, they were not able to reflect that knowledge to their classrooms. Hence, a gap was revealed between theoretical side and practical side of language assessment course taken in training process.

Differently, Lam (2014) designed a comprehensive research which aimed to explore the overall language assessment training programs offered in five Hong Kong English language teacher education institutions. More specifically, whether such programs were facilitative or debilitative in the development of teachers' language assessment literacy was investigated. A survey of the programs and government documents, interviews with selected pre-service teachers and instructors, the evaluation of students' assessment tasks, and the evaluation of assessment courses were utilized to investigate the effect of the programs. Five main themes were reported: the assessment courses in the programs were not effective in enhancing LAL; the application of LAL in real classroom contexts was limited; there was a lack of training in administering assessments of both classroom-based and large-scale; the experiences of the participants in the course were varied, either being positive or negative; the perceptions related assessment was examination-oriented due to their exam-oriented culture. Therefore, in general, the assessment courses were not as effective as expected in developing LAL of pre-service language teachers.

In terms of Turkish pre-service context, Komur (2018) based his research on the awareness and readiness in terms of language assessment. So, he explored Turkish pre-service EFL teachers' knowledge about testing and also questioned whether the content of their assessment training course was sufficient or not in responding to their language assessment needs. 49 senior undergraduates who were prospective EFL teachers answered four open-ended questions. The analysis of their responses yielded that most of the participants were aware of recent developments in ELT field but needed more training on practical techniques of assessment corresponding to the latest innovation in ELT. Therefore, they perceived themselves not qualified enough to conduct an appropriate language assessment despite their expanded knowledge of theories of testing.

Similarly, Hatipoglu (2015) carried out a three-year-long research in order to explore the needs of pre-service EFL students regarding language assessment and testing. She collected needs analysis surveys and interviews from 124 undergraduate students of ELT. The findings indicated that local needs, contexts, and students' previous experiences with assessment had an impact on students' beliefs about English language testing and evaluation training, and one single course was not enough because the students had limited knowledge in language testing and assessment. Therefore, she concluded that the content of the course required changes in order for better training in language assessment.

Discussion and Conclusion

In this section, the interpretive systematic review of the literature and current research studies carried out about LAL have been summarized, synthesized, and also criticized in terms of missing points. Moreover, implications for further practice and research; that is, future directions, have been recommended. Hence, the past, present and future of LAL concept have been illustrated.

The effects of LAL have been recognized when the importance of the relationship between teaching and language assessment is acknowledged. It is because assessment is one of the helpful ways in evaluating the quality of education. However, the concept of LAL research can be thought new compared to AL research (Zolfaghari & Ahmadi, 2016). As a consequence of LAL research, there has been an increasing interest to define what LAL is, to show how it is developed, to find what kind of features it has and to illustrate how it is implemented in classrooms in order to emphasize its role in foreign language education (Csépes, 2014).

As far as the conceptual side of LAL is taken into consideration, this concept has been defined, conceptualized and characterized. Terminologically, LAL refers to the familiarity with assessment procedures and effectively performing them in teaching contexts. The definitions of LAL provided up to this time have had common aspects such as teachers' knowledge, skills, principles, contexts, procedures and understanding of language assessment within the perspective of language teaching education (e.g. Davies, 2008; Fulcher, 2012; Inbar-Lourie, 2008). Nonetheless, it is clear that more research into this multi-layered concept is needed because only one stakeholder (teacher) has been studied mostly, and less attention has been given to the importance of different language contexts such as in-service and pre-service teachers, other stakeholders or cultural issues as well as the ethics in language assessment. Therefore, by taking into account these features, other definitions of LAL might be formed covering all the possible layers of language assessment or different definitions according to different stakeholders apart from Taylor's (2013) model and contexts for a better understanding of this concept. When components or dimensions of LAL are considered, there have been valuable attempts with regard to these in the literature. For instance, Davies (2008), Fulcher (2012), Inbar-Lourie (2008), and Taylor (2013) have portrayed the dimensions of LAL according to their definitions or understandings. It can be deduced that LAL possesses more or less the same components or dimensions with different classifications such as knowledge, process, skills, principles, abilities and contexts. However, Davies' (2008) classification of LAL as knowledge, skills and principles has been appreciated much more in educational contexts. On the other hand, the challenge here is to show how LAL components can be operationalized in language teaching practices. For example, Fulcher (2012) has tried to construct a working definition of LAL by doing research with in-service foreign language teachers. Yet, it is better that theory and practice of LAL should be thought together for different contexts as well as for different stakeholders. In addition to these, the researchers have characterized what kind of features make language teachers assessment literate. Most of them have indicated common characteristics such as being aware of what sound and unsound assessment is, knowledge of assessment theory and pedagogical ways to perform it, ability to match learning outcomes with assessment processes, applying appropriate language assessment tools and so on (e.g. Huang & He, 2016; Inbar-Lourie,

2013b; Khadijeh & Amir, 2015; Rogier, 2014). On the other hand, while some researchers have stated the characteristics of LAL could be valid for all the stakeholders concerned in assessment, some others have stressed that for each stakeholder or academic discipline, characteristics may differ and thus, such characteristics can be taken into consideration. For aforementioned reasons, research into this gap can be useful for educational concerns to develop a deeper understanding of LAL. Besides, the feature of ethics has not been highlighted much; therefore, the ethical side of LAL can be studied in order to contribute to the conceptualization of LAL.

In terms of the research executed about LAL, it is apparent that there are several reviews, theoretical or conceptual studies in the literature. But there is not much exploration about how LAL can be operationalized in foreign language teaching/learning contexts or how it can differ between pre-service and in-service EFL teachers. Therefore, much empirical research is needed to enlighten the concept of LAL as in Fulcher's (2012) study in which both theory and practice of LAL have been investigated. In other words, doing research to construct theory or conceptualization is required instead of discussing LAL in its own. In addition, the outline of studies has yielded that the number of qualitative studies is greater than the other research designs, and interviews as the data collection instrument are dominant. For that reason, various research designs and instruments can be employed so as to clarify and interpret the meaning and implementation of LAL better.

As previously stated, this review covers the empirical research of LAL performed in in-service and pre-service foreign language education contexts between the years of 2014-January and 2018-June. From this perspective, it can be seen that there are more studies with in-service EFL teachers than pre-service EFL teachers.

With regard to in-service EFL teacher context, most of the studies have concluded that the levels of EFL teachers' LAL were low and thus, they needed language assessment training (e.g. Buyukkarci, 2016; Mede & Atay, 2017; Tsagari & Vogt, 2017; Vogt & Tsagari, 2014; Yan, Zhang & Fan, 2018). This training can be a complementary in-service training. From this point of view, Giraldo Aristizabal (2018) and Baker and Riches (2018) found positive effects of workshops regarding language assessment on teachers' development of LAL. So, other in-service training sessions may be designed if teacher education programs fall behind in this respect (Popham, 2009). In a different way, the needs of training are considered as a sign of inadequate pre-service teacher education. Therefore, remedial actions can be taken to improve the content of language assessment courses in foreign language teacher education programs. If pre-service EFL teachers took a good training on language assessment, they would be more successful in their assessment practices as in Yastibas and Takkac's (2018b) study in which previous assessment courses affected the development of LAL in a positive way. Even, if this kind of strategy were taken as a policy like in Sellan's (2017) study, training programs would produce more capable and devoted foreign language teachers in terms of language assessment. In addition, some studies that have investigated the effect of demographic variables and contextual issues have found that the context where teachers work affects their assessment practices and sometimes, EFL teachers could not respond to the needs of that context (e.g. Tuzcu-Eken, 2016; Vogt & Tsagari, 2014; Yan, Zhang & Fan, 2018). On the other hand, most of demographic variables have not influenced LAL. Specifically, researchers have focused on teaching experience but have

not found a positive or facilitative effect in improving LAL of EFL teachers (e.g. Buyukkarci, 2016; Hakim, 2015; Jannati, 2015; Oz & Atay, 2017; Xu & Brown, 2017). It can be assumed that training and context are crucial factors whereas experience does not make a difference in LAL enhancement. Finally, nearly all the studies with in-service EFL teachers reviewed have revealed that teachers have some knowledge of language assessment, but they are not able to put that knowledge into practice. Accordingly, the practical side of language assessment should be highlighted.

Considering pre-service EFL teacher context, as noted before, there are not many empirical studies in recent years. However, up-to-date research into this context has shown that there is a gap between theory and practice of language assessment as discussed by in-service EFL teachers. In other words, the finding of the research in the last five years has indicated that prospective EFL teachers complained about the emphasis put more on theory rather than practice (e.g. Komur, 2018; Viengsang, 2016). Thus, a balance between theory and practice is required for better language assessment training. For this goal, the training of LAL can encompass "an appropriate balance of technical know-how, practical skills, theoretical knowledge, and understanding of principles, but all firmly contextualized within a sound understanding of the role and function of assessment within education and society" (Taylor, 2009, p. 27). In addition, because of this kind of imbalance, EFL teacher candidates were found to have lower levels of LAL (e.g. Komur, 2018). Likewise, the training courses on language assessment in foreign language education have appeared to be ineffective in supporting the development of LAL and the content of such courses have fallen short in equipping their undergraduate students with necessary knowledge and skills required for good practices of language assessment (e.g. Hatipoglu, 2015; Lam, 2014). All of these studies have concluded that language assessment training programs in foreign language education should be improved in order to provide a better education. It is because to develop LAL of teacher candidates is believed to be a necessary component of foreign language teacher training program (DeLuca & Klinger, 2010; Herrera & Macias, 2015). For instance, the content of the programs may be revised and renewed according to the needs of their attenders as well as the developments and changes in foreign language education and assessment field. One of the points also attracting attention is prospective EFL teachers' inability to interpret assessment results (Lam, 2014). Therefore, the training courses should equally give importance to all the required characteristics of language assessment literate teachers. Besides, to focus on the needs of LAL training might be useful to graduate qualified EFL teachers. With respect to this idea, it should be emphasized that pre-service language teacher training is a critical phase in developing teacher competencies such as language assessment. Thus, more research can be carried out to show what may be done to improve LAL of teacher candidates and how foreign language education programs might be shaped in line with such directions.

After all, this systematic review is an attempt to demonstrate the current place of LAL, its importance in the literature, and strengths and weaknesses of studies conducted in recent five years in terms of foreign language education context. It has also provided some implications for practice and recommendations for further research. It is hoped that this review has contributed to the LAL research field by discussing, summarizing, synthetizing and suggesting. Furthermore, it is believed that this review reveals new

perspectives regarding LAL. Still, researchers must carry on investigating LAL in order to shed light on its hidden points.

References

*Baker, B. A., & Riches, C. (2018). The development of EFL examinations in Haiti: Collaboration and language assessment literacy development. *Language Testing, 35*(4), 557-581. doi:10.1177/0265532217716732

Bayat, K., & Rezaei, A. (2015). Importance of teachers' assessment literacy. *International Journal of English Language Education, 3*(1), 139-146.

Berry, V., & O'Sullivan, B. (2016). *Assessment literacy for language teachers*. Retrieved from http://tea.iatefl.org/wp-content/uploads/2015/10/Vivien-Berry-and-Barry-OSullivan.pdf

*Buyukkarci, K. (2016). Identifying the areas for English language teacher development: A study of assessment literacy. *Pegem Egitim ve Ogretim Dergisi [Pegem Journal of Education and Instruction], 6*(3), 333-346. doi:10.14527/pegegog.2016.017

Cooper, H., Hedges, L. V., & Valentine, J. C. (2009). *The handbook of research synthesis and meta-analysis* (2nd ed.). NY, USA: Russell Sage Foundation.

Csépes, I. (2014). Language assessment literacy in English teacher training programmes in Hungary. In J. Hovarth & P. Medgyes, (Eds.), *Studies in Honour of Marianne Nikolov* (pp. 399-411). Pécs: Lingua Franca Csoport.

Davies, A. (2008). Textbook trends in teaching language testing. *Language Testing, 25*(3), 327-347. doi:10.1177/0265532208090156

DeLuca, C., & Klinger, D. A. (2010). Assessment literacy development: Identifying gaps in teacher candidates' learning. *Assessment in Education: Principles, Policy & Practice, 17*(4), 419-438. doi:10.1080/0969594X.2010.516643

Djoub, Z. (2017). Assessment literacy: Beyond teacher practice. In R. Al-Mahrooqi, C. Coombe, F. Al-Maamari & V. Thakur (Eds.), *Revisiting EFL assessment* (pp. 9-27). Switzerland: Springer International Publishing.

*Fulcher, G. (2012). Assessment literacy for the language classroom. *Language Assessment Quarterly, 9*(2), 113-132. doi:10.1080/15434303.2011.642041

Giraldo, F. (2018). Language assessment literacy: Implications for language teachers. *Profile: Issues in Teachers' Professional Development, 20*(1), 179-195. doi:10.15446/profile.v20n1.62089

*Giraldo Aristizabal, F. G. (2018). A Diagnostic study on teachers' beliefs and practices in foreign language assessment. *Íkala: Revista de Lenguaje y Cultura, 23*(1), 25-44. doi:10.17533/udea.ikala.v23n01a04

Gotch, C. M., & French, B. F. (2014). A systematic review of assessment literacy measures. *Educational Measurement: Issues and Practice, 33*(2), 14-18.

*Hakim, B. (2015). English language teachers' ideology of ELT assessment literacy. *International Journal of Education & Literacy Studies, 3*(4), 42-48. doi:10.7575/aiac.ijels.v.3n.4p.42

*Hatipoglu, C. (2015). English language testing and evaluation (ELTE) training in Turkey: expectations and needs of pre-service English language teachers. *ELT Research Journal, 4*(2), 111-128.

Herrera, L., & Macias, D. (2015). A call for language assessment literacy in the education and development of teachers of English as a foreign language.

Colombian Applied Linguistics Journal, 17(2), 302-312. doi:10.14483/udistrital.jour.calj.2015.2.a09

Huang, J., & He, Z. (2016). Exploring assessment literacy. *Higher Education of Social Science, 11*(2), 18-27. doi:10.3968/8727

Inbar-Lourie, O. (2008). Constructing a language assessment knowledge base: A focus on language assessment courses. *Language Testing, 25*(3), 385-402. doi:10.1177/0265532208090158

Inbar-Lourie, O. (2013a). Language assessment literacy. In C. A. Chapella (Ed.), *The Encyclopedia of Applied Linguistics* (pp. 1-9). Blackwell Publishing Ltd. doi:10.1002/9781405198431.wbeal0605

Inbar-Lourie, O. (2013b, November). *Language assessment literacy: What are the ingredients?* Paper presented at the 4th EALTA-CBLA SIG Symposium, Nicosia, Cyprus. Retrieved from http://www.ealta.eu.org/events/CBLA-cyprus2013/Lectures_workshops/O_Inbar-Lourie%20-%20plenary%20-1.pdf

Inbar-Lourie, O. (2017). Language assessment literacy. In E. Shohamy, L. Or & S. May (Eds.), *Language Testing and Assessment* (pp. 257-270). Springer International Publishing AG. doi:10.1007/978-3-319-02261-1_19

*Jannati, S. (2015). ELT teachers' language assessment literacy: Perceptions and practices. *The International Journal of Research in Teacher Education, 6*(2), 26-37.

Khadijeh, B., & Amir, R. (2015). Importance of teachers' assessment literacy. *International Journal of English Language Education, 3*(1), 139-146. doi:10.5296/ijele.v3i1.6887

*Komur, S. (2018). Preservice English teachers' assessment awareness: Level of readiness for classroom practice. *The Journal of Language Teaching and Learning, 8*(1), 109-121.

*Lam, R. (2014). Language assessment training in Hong Kong: Implications for language assessment literacy. *Language Testing, 32*(2), 169-197. doi:10.1177/0265532214554321

*Mede, E., & Atay, D. (2017). English language teachers' assessment literacy: The Turkish context. *Dil Dergisi-Ankara Universitesi TOMER [Language Journal-Ankara University TOMER], 168*(1), 43-60.

Mertler, C. A. (2003, October). *Pre-service versus In-service teachers' assessment literacy: Does classroom experience make a difference?* Paper presented at the Annual Meeting of the Mid-Western Educational Research Association, Columbus, OH, USA. Retrieved from the ERIC database (ED482277).

*Oz, S., & Atay, D. (2017). Turkish EFL instructors' in-class language assessment literacy: Perceptions and practices. *ELT Research Journal, 6*(1), 25-44.

Petticrew, M., & Roberts, H (2006). *Systematic reviews in the social sciences: A practical guide*. Oxford, UK: Blackwell Publishing.

Pill, J., & Harding, L. (2013). Defining the language assessment literacy gap: Evidence from a parliamentary inquiry. *Language Testing, 30*(3), 381-402. doi:10.1177/0265532213480337

Popham, W. J. (2009). Assessment literacy for teachers: Faddish or fundamental? *Theory into Practice, 48*(4), 4-11. doi:10.1080/00405840802577536

Rea-Dickins, P. (2004). Understanding teachers as agents of assessment. *Language Testing, 21*(3), 249-258. doi:10.1191=0265532204lt283ed

Rogier, D. (2014). Assessment literacy: Building a base for better teaching and learning. *English Language Teaching Forum, 52*(3), 2-13.

Scarino, A. (2013). Language assessment literacy as self-awareness: Understanding the role of interpretation in assessment and in teacher learning. *Language Testing, 30*(3), 309-327. doi:10.1177/0265532213480128

*Sellan, R. (2017). Developing assessment literacy in Singapore: How teachers broaden English language learning by expanding assessment constructs. *Papers in Language Testing and Assessment, 6*(1), 64-87.

Stabler-Havener, M. L. (2018). Defining, conceptualizing, problematizing, and assessing language teacher assessment literacy. *Teachers College, Columbia University Working Papers in Applied Linguistics & TESOL, 18*(1), 1-22.

Stiggins, R. J. (1995). Assessment literacy for the 21st century. *Phi Delta Kappan, 77*(3), 238-245.

Taylor, L. (2009). Developing assessment literacy. *Annual Review of Applied Linguistics, 29*, 21-36. doi:10.1017/S0267190509090035

Taylor, L. (2013). Communicating the theory, practice and principles of language testing to test stakeholders: Some reflections. *Language Testing, 30*(3), 403-412. doi:10.1177/0265532213480338

*Tsagari, D., & Vogt, T. (2017). Assessment literacy of foreign language teachers around Europe: Research, challenges and future prospects. *Papers in Language Testing and Assessment, 6*(1), 41-63.

*Tuzcu-Eken, D. (2016). Testing in English classes in vocational schools of higher education. *Electronic Journal of Vocational Colleges, 6*(1), 38-47.

*Viengsang, R. (2016). Exploring pre-service English teachers' language assessment literacy. *Modern Journal of Language Teaching Methods (MJLTM), 6*(5), 432-442.

*Vogt, K., & Tsagari, D. (2014). Assessment literacy of foreign language teachers: Findings of a European study. *Language Assessment Quarterly, 11*(4), 374-402. doi:10.1080/15434303.2014.960046

Wach, A. (2012). Classroom-based language efficiency assessment: A challenge for EFL teachers. *Glottodidactica, 39*(1), 81-92.

*Xu, H. (2017). Exploring novice EFL teachers' classroom assessment literacy development: A three-year longitudinal study. *Asia-Pacific Educational Research, 26*(3-4), 219-226. doi:10.1007/s40299-017-0342-5

*Xu, Y. (2016). Assessment planning within the context of university English language teaching (ELT) in China: Implications for teacher assessment literacy. *Australian Review of Applied Linguistics, 39*(3), 233-254. doi:10.1075/aral.39.3.o2xu

*Xu, Y., & Brown, G. T. L. (2017). University English teacher assessment literacy: A survey-test report from China. *Papers in Language Testing and Assessment, 6*(1), 133-158.

*Yan, X., Zhang, C., & Fan, J. J. (2018). "Assessment knowledge is important but …": How contextual and experiential factors mediate assessment practice and training needs of language teachers. *System, 74*, 158-168. doi:10.1016/j.system.2018.03.003

*Yastibas, A. E., & Takkac, M. (2018a). Understanding language assessment literacy: Developing language assessments. *Journal of Language and Linguistic Studies, 14*(1), 178-193.

*Yastibas, A. E., & Takkac, M. (2018b). Understanding the development of language assessment literacy. *Bingol University Journal of Social Sciences Institute, 8*(15), 89-106. doi:10.29029/busbed.364195

Zolfaghari, F., & Ahmadi, A. (2016). Assessment literacy components across subject matters. *Cogent Education, 3*, 1-16. doi:10.1080/2331186X.1252561

Note: References marked with an asterisk indicate the studies in this review.