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Middle School Boys' and Girls' Career Aspirations in Science and Mathematics

Nurcan Kahraman

Abstract

The aim of this study is to examine secondary school students' desire to pursue a career in science and mathematics in 2011 and 2015, taking into account gender differences, and to examine how variables related to students' socioeconomic status, motivation and performance predict the desire of female and male students to pursue a career in science and mathematics. The number of books, study environment at home and parents' educational levels were analyzed as SES variables. While motivational variables were students' self-efficacy and task value beliefs, performance related variables were their achievement and engagement. The data of the eighth-grade students from Trends in International Mathematics and Science Study (TIMSS) 2011 and 2015 were analyzed. To investigate the year differences of girls' and boys' career aspirations in science and mathematics, Chi-Square test was performed. In addition, logistic regression analysis was conducted to investigate the relation between students' SES, motivation, performance and career aspirations for 2011 and 2015 data separately. The results have indicated that students' motivation was the strongest and the most common predictor of career aspirations in science and mathematics for boys and girls.

Keywords: career aspirations, science, mathematics, TIMSS

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Introduction

Nowadays, technological revolution is growing more rapidly than ever and has affected many aspects of life and changed the needs of the world. One of the results of this major shift is the increasing need for people employed in STEM fields (science, technology, engineering, and mathematics) for countries. (Briggs, 2017; OECD, 2013; That et al., 2012). Hence, nations have started to revise their educational system in order to raise the coming generation in a much more innovative way and started to direct them towards pursuing a STEM-related career (Lederman, 2008). Females are an underrepresented group in STEM-related careers (e.g., Xie & Shauman, 2004). For example, in Turkey, while there are 64% males in STEM-related occupations, there are only about 36% females working in a STEM field (Turkish Industry and Business Association, 2014). Actually, the reason for this gender gap in STEM careers is not because of achievement; recent relevant research suggests that girls have started to obtain higher grades than

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boys (e.g., Bursal, 2013). Moreover, regarding course attendance, there is no significant difference between them (National Science Board, 2014). Wang and Degol (2013) suggest that the underlining reason for girls' and boys' selection of a STEM career might be linked to their motivational beliefs such as self-efficacy and task value. Besides investigating the relations among motivation, career aspirations, performance, and contextual factors by considering gender differences is important and may help researchers to understand underlying factors of career aspirations and may be helpful to encourage girls toward STEM fields (Wang, 2012).

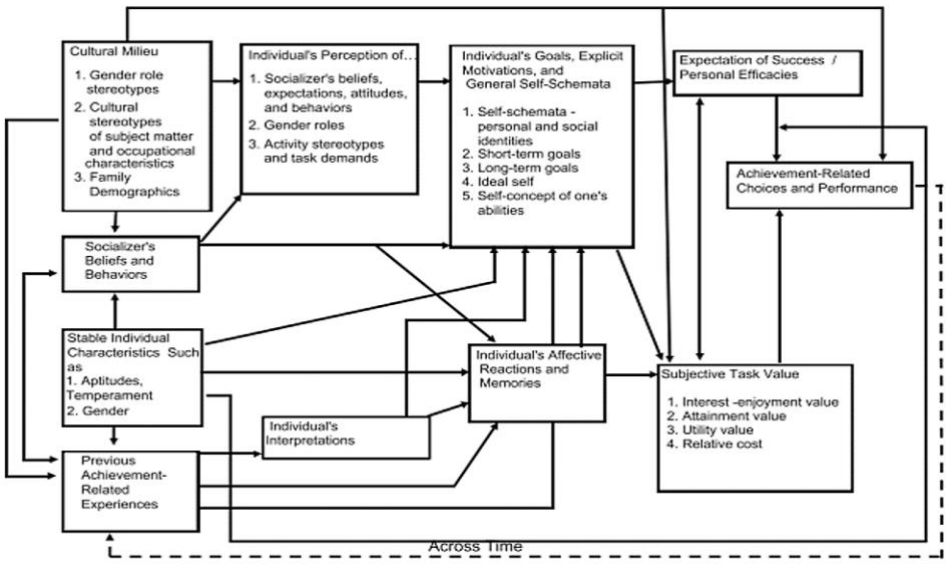
Encouraging people to prefer STEM-elated careers at young ages is critical based on the social and psychological researchers' studies (e.g., Davenport et al., 2021); in addition, it is widely known that people shape their occupational decisions during the adolescence years (Bandura et al., 2001). Moreover, relevant researchers suggest that entering in a STEM pathway starts in childhood and adolescence (Wang & Degol, 2013). Consistently, prior research about STEM careers underlines the importance of secondary school times for career inspiration since it has significant impact on a career decision for upcoming years (Gibbons & Borders, 2010; Jackson et al., 2011). For instance, Sadler and his colleagues (2012) suggest that students' career interest before beginning high school is an important predictor of their career interest in the later stages of high school. Besides, 7th to 9th years is seen as a key period to develop STEM career interest and motivation (Simpkins et al., 2006). Thus, this study aims to investigate the underlying reasons for middle school students' career aspirations in science and mathematics considering gender differences.

Theoretical Framework

To explain people's achievement-related behaviors, expectancy-value theory presents a comprehensive framework about the contextual and psychological factors that underline individuals' performance and career aspirations (Wigfield & Eccles, 2000). According to this theory, if students believe they can accomplish the task (expectation of success) and consider it valuable (task value), they tend to make achievement-related choices, such as career achievements. Along with it, the theory also suggests that students' social contexts such as the school context or house-life context are also important factors to understand individual differences in career aspirations (e.g., Eccles et al., 1997; Eccles, 2007). The theoretical framework of the career choices according to expectancy-value theory is presented in Figure 1. To emphasize, expectancy-value theory analyzes students' academic success, their achievement-related choices and aspirations, including the pursuit of a career, within a wide range (Eccles, 2005). The theory builds on many aspects, such as sociocultural, biological, contextual, psychological and achievement performance factors (Wang & Degol, 2013). In the current study, middle school students' career aspirations were investigated by considering sociocultural, psychological and performance factors of expectancy-value theory.

Figure 1

The Theoretical Framework of the Career Choices According to Expectancy-value Theory from Eccles (2009)



Links Between the Socio-economic Status of Family and Career Interest

Expectancy-value theory underlines the importance of students' social environment such as peers, and family context which can lead students to engage in different educational experiences which affect their career aspirations in STEM (Wang, 2012). For instance, students that come from lower socio-economic status (SES) families are generally seen as disadvantaged in terms of accessing higher education compared to their peers coming from higher SES families (Flores, 2007). Concerning having STEM-related occupations, one of the underrepresented groups is low SES students (Shaw & Barbuti, 2010). For instance, Leslie et al. (1998) found that parents' education level and income affect students' career choice. Actually, SES of students has been one of the main interests of educational researchers for some time. For example, there are studies that investigate the effects of SES on different outcomes such as students' achievement (e.g., Gustafsson et al., 2013) or on motivation (e.g., Tucker-Drob & Harden, 2012). On the other hand, Niu (2017) suggests that although socioeconomic status of family and STEM enrollment is an inequality dimension, it does not get the attention that it deserves. Hence, in the current study, SES was also considered while investigating middle school students' career aspirations in science and mathematics.

Links Between Motivational Beliefs and Career Interest

Expectancy-value theory suggests that students' expectancy and task value beliefs directly affect students' performance related behaviors, achievement related choices, and career aspirations (Wigfield & Eccles, 2000). Task value refers to the answer to the question "Why should I do this task?". In other words, students' task value beliefs are their reasons to engage in a task (Eccles & Wigfield, 2002). Eccles and her colleagues (1983) investigate students' task value beliefs in four components: utility value, intrinsic value, attainment value, and cost. Utility value is concerned with how the task is beneficial for students' personal goals. Intrinsic value means how much students like or enjoy doing the task. Thirdly, attainment value refers to the importance of the relation between the task and students' identity and ideals. The last component of task value, cost, is concerned with the various costs of the task such as economic, social, or psychological costs. (Eccles, 2009; Wigfield & Eccles, 2002). The other motivational component of expectancy-value theory is expectancy for success which refers to the students' beliefs about their performance for upcoming tasks (Eccles et al., 1983; Wigfield & Eccles, 2002). Wigfield and Eccles (2002) proclaim that expectancy success is different from outcome expectations. Besides, it is a bit similar to Bandura's self-efficacy beliefs. Based on this suggestion and the conceptuality of TIMSS data in the present study, students' self-efficacy beliefs were analyzed to represent students' expectancy beliefs. Self-efficacy can be defined as an individual's judgments of his/her capacity towards accomplishing the task successfully. In a simpler manner, the answer of "Can I do this task?" refers to individuals' self-efficacy beliefs (Bandura, 1977; Pintrich & Schunk, 2002; Zimmerman, 2000).

According to the theory, students' motivational beliefs play a prominent role on students' achievement-related behaviors and their career aspirations (Eccles et al., 1983). For instance, Riegle-Crumb et al. (2011) investigated how the self-concept, intrinsic value and achievement predict science/mathematics career aspirations. According to the results, intrinsic value was the most accurate predictor amongst the variables listed. Additionally, in a longitudinal study, Lauermann et al. (2017) investigated the predictive role of motivational beliefs in explaining attaining a mathematics career. They collected the data in four different periods of time: in elementary school years, in high school years (grade 9 and grade 12) and in adulthood. The results confirmed that adolescents' motivational beliefs were the strongest predictor of their adulthood mathematics-related careers. In a recent study, Ahmed and Mudrey (2019) investigated the relation between motivational beliefs and STEM career aspiration. They handled the topics of intrinsic value, utility value and self-concept as motivational beliefs. Results suggest that students' motivation, especially their task value beliefs, are important predictors of their career aspiration in STEM. Briefly, the relevant research confirmed that students who think they have the ability to achieve science or mathematics, and those who enjoy learning them and think that science or mathematics will be useful for their lives, tend to choose a career in science or mathematics.

Links Between Achievement, Engagement and Career Interest

Students' achievement also has an important effect on their career aspirations. Expectancy-value theory also includes this dimension in the framework and suggests that students' competencies affect their achievement-related choices such as their career choice (Eccles, 2009; Wang et al., 2015). To set an example to the link between achievement and career aspiration, Watson et al. (2002) investigated adolescents' career aspirations and suggested that high-achieving female students are more likely to choose prestigious occupations than their lower-achieving peers. Furthermore, students' interactions with learning activities are indicators of their engagement. These interactions can be either observable or unobservable (Deci & Ryan, 2000). According to Fredricks et al. (2004) engagement is a multidimensional structure. The first domain of this structure is behavioral engagement, and it can be defined as students' participation in school activities. Performing the given task or course enrollment can be given as examples of behavioral engagement. The second domain, emotional engagement, is related to students' positive or negative feelings about the class. Thirdly, cognitive engagement refers to students' mental efforts for learning. A relevant research study suggests that students' engagement has a significant influence on students' career aspirations (Durik et al., 2006). The connection between career development and school engagement is a bit controversial while some of the studies suggest that engaging in learning activities related to science or mathematics will influence career choices (Maltese & Tai, 2010; Wang & Degol, 2014). On the contrary some of them suggest that school engagement does not affect students' career development; however, students' career aspirations have an effect on their school engagement (Kenny et al., 2006).

Turkish Educational Context

International assessments like TIMSS provide opportunity to the participating countries to analyze results, compare them with other countries' performance and monitor their educational policy (Fischman et al., 2019). Turkey started to participate in TIMSS in 1999 and both the government and educational researchers are x interested in the results of this international test. For instance, achievement in science or mathematics (Uzun et al., 2010), motivation towards science or mathematics (e.g., Dogan & Barış, 2010) and the school or teacher variables (e.g., Atar, 2014) are some of the issues that were analyzed with TIMSS data from Turkish researchers. However, according to the author's knowledge students' career aspirations are not much analyzed by Turkish researchers from TIMSS perspective.

In 2011, primary schools consisted of two levels: lower primary (grade 1 to 5), and upper primary (grade 6 to 8). Students took proficiency examinations in each grade of upper primary levels. According to the average score of three proficiency examinations, students were able to choose a high school. They could enter a regular high school, science high school or different types of vocational high schools. Science high schools were one of the most popular schools because students who graduate from these kinds of schools were more likely to enter STEM-related programs than their peers who

graduate from a regular high school (Argon & Soysal, 2012). There was an educational reform in 2012 in Turkey, which constituted three new levels: primary school (grade 1 to 4), middle school (grade 5 to 8) and high school (grade 9 to 12). The proficiency examinations were repealed at grade 6 and grade 7. Students took proficiency examinations in grade 8 two times in the first and second semester (Ozturk & Aksoy, 2014). Similar to the previous system, there were different types of high schools and the average score of two proficiency examinations were used as the transition score to enter a high school. Besides, one of the other revisions was done in science curriculum and science-related career introductions had started to take a part of the science programs (MoNE, 2013). Hence, there is a possibility that middle school students of 2015 might have knowledge about science-related occupations more than age-mates of 2011.

Research Questions and Proposed Model

In the light of the aforementioned research, this study aims to investigate i) girls' and boys' career aspirations in science and mathematics in 2011 and 2015, ii) trends in the prediction of girls' and boys' career aspirations in science, and iii) trends in prediction of girls' and boys' career aspirations in mathematics. To reach these aims, the following research questions herewith were examined:

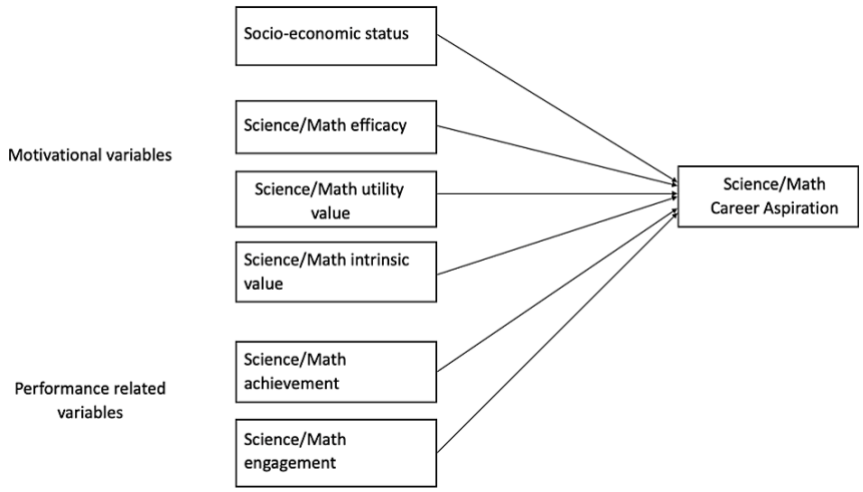
- Are there any significant differences between girls' and boys' career aspirations in science/ mathematics between 2011 and 2015?
- How do the combination of SES, science motivation and science performance predict the likelihood of Turkish middle school students' science career aspirations for girls in 2011 and in 2015?
- How do the combination of SES, science motivation and science performance predict the likelihood of Turkish middle school students' science career aspirations for boys in 2011 and in 2015?
- How do the combination of SES, mathematics motivation and mathematics performance predict the likelihood of Turkish middle school students' mathematics career aspirations in science for girls in 2011 and in 2015?
- How do the combination of SES, mathematics motivation and mathematics performance predict the likelihood of Turkish middle school students' mathematics career aspirations in science for boys in 2011 and in 2015?

To address all the research questions except the first one a prediction model was proposed as presented in Figure 2. Moreover, the model was tested based on gender and years for mathematics and science separately. In the light of the expectancy-value model of motivated behavioral choice, students' task value and self-efficacy beliefs were analyzed as their motivational beliefs. Besides, achievement and engagement were analyzed as their performance related behaviors. Furthermore, socio-economic status,

one of the indicators of social context, was also considered while investigating students' science and mathematics related career aspirations.

Figure 2

Prediction Model for Science/Mathematics Career Aspiration



Method

Design of the Study

This study aims to investigate middle school girls' and boys' career aspirations in science and mathematics via using TIMSS 2011 and 2015 data. The combination of correlational and causal-comparative research design was used to investigate the relationship among students' SES, motivation, performance, and career aspirations and to compare different groups. This research type is used to investigate the differences between groups which already exist without any manipulation (Frankel & Wallen, 2006).

Sample

A two-stage stratified cluster sampling was used to determine the sample of TIMSS. Countries determine stratification variables to select representable samples. For example, Turkey determines geographical region as a stratification variable. In the second stage, schools are sorted by stratification variables. Then the participating schools are selected by systematic sampling method (Joncas & Foy, 2012). 6928 eighth

grade, middle school students participated in TIMSS 2011. There were 3414 (49.3%) girls and 3511 (50.7%) boys in the sample. 56.3% of participants reported that there are between 1-25 books at their homes. In 16.2% of participants' homes, there are more than 100 books. 32.5% of them have neither their own room nor an internet connection at their homes. Regarding TIMSS 2015, 6079 eighth-grade students participated in the study. 48.2% of them were girls and 51.4% of them were boys. While 51.3% of them have 1-25 books, 18.2% of them have more than 100 books at their homes. Besides this, 20.4 % of them are students without an internet connection and with no individual rooms. The demographic description of samples presented in Table 1.

Table 1

Demographic Profiles of Students

	2011		2015	
	Girls frequency (%)	Boys frequency (%)	Girls frequency (%)	Boys frequency (%)
Number of books at home				
0-10 books	554 (16.9)	747 (22.1)	390 (13.3)	589 (18.8)
1- 25 books	1283 (37.2)	1291 (36.7)	1032 (35.1)	1082 (34.5)
26-100 books	978 (27.8)	917 (25.4)	900 (30.6)	935 (29.8)
101- 200 books	359 (10.7)	332 (9.7)	342 (11.6)	280 (8.9)
+ 200 books	226 (7.3)	204 (6.1)	258 (8.8)	217 (6.9)
Home study support				
Neither own room nor internet connection	1079 (31.6)	1153 (32.8)	584 (19.8)	642 (20.5)
Either own room or internet connection	1232 (36.1)	1281 (36.5)	1072(36.4)	1185 (37.8)
Both own room and internet connection	1086 (31.8)	1046 (29.8)	1259 (42.8)	1259 (40.1)
Highest education level of parents				
University or higher	235 (6.9)	263 (7.5)	358 (12.2)	394 (12.6)
Post-secondary but not university	151 (4.4)	163 (4.6)	156 (5.3)	165 (5.3)
Upper secondary	823 (24.1)	759 (21.6)	789 (26.8)	880 (28.1)
Lower secondary	480 (14.1)	497 (14.1)	892 (30.3)	897 (28.6)
Some primary, lower secondary or no school	1656 (48.5)	1659 (47.2)	654 (22.2)	612 (19.5)
SES category				
Low SES	1827 (53.5)	1955 (55.6)	1146 (38.9)	1228 (39.2)
Middle SES	1459 (42.7)	1423 (40.5)	1577 (53.6)	1721 (54.9)
High SES	126 (3.7)	125 (3.6)	206 (7)	162 (5.2)

Measures

Career Aspirations in Science and Mathematics

In TIMSS, students were asked how much they agree with the statement: "I would like a job involved with using science." Same question was asked for mathematics, in the same exact format. Since there are some studies that use similar questions to assess students' career aspirations (e.g., Farmer & Chung, 1995; Riegle-Crumb et al., 2011; Watts et al., 2015), it was also analyzed as a single item, career aspiration measure in the present study. There were four possible answer choices: 1 "agree a lot", 2 "agree a little", 3 "disagree a little" and 4 "disagree a lot". Since the purpose of the present study is to investigate students who have a strong aspiration for a career in science and mathematics, "agree a lot" was coded as 1, and the other answers were coded as 0 (Riegle-Crumb et al., 2011). As a result, two dummy variables were obtained from the data.

Socioeconomic Status

In TIMSS, students were asked about the number of books they have at their home, their parents' education level and their home study support amounts. The question about the book quantity had five answer choices: 0-10 books, 11-25 books, 26-100 books, 101-200 books and more than +200 books. Additionally, along with the home study support question students were asked if they have their own room and have internet connection. TIMSS created a continuous variable labelled "home educational resources" with these three questions, since these questions are the common indicators of socioeconomic status in the relevant literature (Buchmann, 2002). This variable was treated as socioeconomic status in the present study.

Engagement and Motivational Beliefs

Within the scope of TIMSS, students' engagement and motivational beliefs about science/mathematics were investigated with four-point Likert scales ranging from 1 (disagree a lot) to 4 (agree a lot).

Self-efficacy. Students' judgements about their capacity to do a task refers to their self-efficacy beliefs (Pintrich & Schunk, 2002). In TIMSS, there is a sub-scale labelled student confidence in science/mathematics. However, Evans (2015) argues that relevant TIMSS items are better to assess students' self-efficacy beliefs rather than their self-confidence according to the definition of these terms. Although self-efficacy and confidence have similarities, Bandura (1977) underlines that they are not the same variables. Moreover, he underlines that self-confidence concerns students' overall feelings; it is not domain specific. Supporting this idea, there are some studies which handle self-confidence scale as self-efficacy (Hwang & Ham, 2021). Hence, in the

present study, these items are considered as students' self-efficacy beliefs. There were nine items such as "I usually do well in science/mathematics". The reliability coefficient of Cronbach's alpha was calculated .87 for the mathematics with both 2011 and 2015 data and for science with 2011 data. Besides that, the reliability coefficient was .84 for the science with 2015 data.

Intrinsic Value. It concerns students' enjoyment of the task (Eccles et al., 1983). TIMSS assesses students' liking or enjoying x learning science with 7 items in 2011, and with 9 items in 2015. Regarding mathematics, there are 6 factors in 2011 and 9 items in 2015 in liking mathematics scale. To keep consistency only common items were used. Hence there were six items such as "I enjoy learning science/mathematics". The reliability coefficient of Cronbach's alpha was calculated .83 for the mathematics with 2011 data and .92 with 2015 data. Regarding science, the coefficient was .81 for 2011 and .87 for 2015.

Utility Value. Students' perceptions about usefulness of the task refers to their utility value beliefs (Eccles et al., 1983). There are 5 items to assess students' utility value in science in TIMSS 2011 data, and 8 items in 2015 data. Parallel questions were asked for students' mathematics value. The example item from this scale is "I think learning science/mathematics will help me in my daily life" The reliability coefficient of Cronbach's alpha was calculated .73 for the mathematics with 2011 data and .86 with 2015 data. Regarding science, the coefficient was .79 for 2011 and .89 for 2015.

Engagement. Behavioral engagement refers to students' participation in learning activities in the class Fredricks et al. (2004). TIMSS assesses students' engagement with five items in 2011 and with 10 items in 2015 in science and mathematics separately. Additionally, students were asked to answer the following question: "How much do you agree with these statements about your science/mathematics lessons?" The example item from this scale is "I am interested in what teachers say." The reliability coefficient of Cronbach's alpha was calculated .60 for the mathematics scale.

Data Analysis Procedure

In the TIMSS web site the data for 2011 (https://timssandpirls.bc.edu/timss2011/international-database.html) and 2015 (https://timssandpirls.bc.edu/timss2015/international-database/) were presented and open for researchers. To create the data for Turkish students, International Database (IDB) analyzer version 4.0 was used. It was developed by the IEA Data Processing and Research Center for the Evaluation of Educational Achievement (IEA) to analyze large-scale survey data, and considers sampling weights (IEA, 2013). To work data from different years, two data sets were merged via SPSS (IEA, 2016). Moreover, some of the sub-scales include additional items in 2015 data. Since inputs can affect the regression (Gelman, 2008), all the variables are transformed to z-scores before conducting analyses. After the transformation, none of the correlations was changed.

For the first research question, to compare students' career aspirations regarding years, the Chi-Square test was performed via SPSS 26 with a complex sample module. Chi-Square test has two main assumptions: variables should be ordinal or nominal and independent so that there was no violation of assumptions. For the other research questions, to predict students' career aspirations, logistic regression analyses were conducted via IDB analyzer. Before performing analyses, assumptions were checked. Firstly, Box-Tidwell test was conducted to check whether the relationships between independent variables and the logic were linear. The interaction of the SES variable was significant, which violates the assumption. However, with large samples this violation is not very concerning (Wuensch, 2012). Moreover, there was no correlation coefficient above .80 among variables, so there was no violation for multicollinearity assumption. Besides, preliminary analyses show that none of the variables has missing value more than 3%, missing data analyses were not conducted. (Tabachnick & Fidell, 2013).

Results

Descriptive Statistics

To investigate middle school students' profile in 2011 and in 2015, descriptive analyses were conducted.

Career Aspiration in Science and Mathematics

Turkish adolescents' career aspirations in science were approximately 30% in 2011, and 40% in 2015. In addition to that, career aspirations in mathematics were approximately 23% in 2011, and 27% in 2015. Frequencies of these variables are presented in Table 2.

Table 2

Descriptive Results for Career Aspiration in Science and Math

	2011		2015	
	Girls	Boys	Girls	Boys
	frequency (%)	frequency (%)	frequency (%)	frequency (%)
want science career	973 (28.3)	1113 (32.1)	1186 (41)	1237 (39.7)
want math career	665 (19.4)	935 (27)	681 (23)	948 (30.6)

Students' Engagement and Motivation Toward Science and Mathematics

Descriptive statistics were used to investigate students' engagement and motivation profiles. According to the results, the profiles of the students indicated that girls tend to engage in science and mathematics at higher rates. Besides, they find science and mathematics valuable and have positive evaluations about their ability to succeed in them. On the other hand, there were no practical significant differences between girls and boys regarding engagement and motivation. Besides, descriptive results of these variables are summarized in Table 3.

Table 3

Descriptive Results for Engagement and Motivational Variables

	2011		2015	
	Girls Estimate (SE)	Boys estimate (SE)	Girls estimate (SE)	Boys estimate (SE)
Motivational Variables				
Math self-efficacy	-.007 (.019)	.046 (.018)	-.039 (.022)	.026 (.013)
Science self-efficacy	.037 (.019)	-.010 (.018)	.094 (.021)	-.023 (.014)
Math intrinsic value	.034 (.018)	-.023 (.017)	.019 (.020)	-.007 (.018)
Science intrinsic value	.099 (.018)	-.082 (.018)	.130 (.019)	-.045 (.014)
Math utility value	.045 (.017)	-.059 (.018)	.075 (.019)	-.047 (.014)
Science utility value	.071(.017)	-.054 (.018)	.105 (.018)	-.037 (.014)
Performance-related Variables				
Engagement in math	.132 (.018)	-.103 (.018)	.099 (.018)	-.021 (.014)
Engagement in science	.114 (.018)	-.100 (.018)	.147 (.017)	-.048 (.014)
Math achievement	.074 (.019)	-.003 (.019)	.064 (.020)	.004 (.014)
Science achievement	.118 (.018)	-.037 (.019)	.161 (.018)	-.034 (.014)

Science and Mathematics Achievement

TIMSS assesses students' performance with a scale range 0-1000, although students' performances generally vary from 300 to 700. Turkish students increased their science scores significantly from 2011 (*mean* = 483) to 2015 (*mean* = 493). However, the effect size value (d = .01) implies that it is too small to consider (Cohen, 1988). Regarding mathematics achievement, there was no significant difference between 2011 (*mean* = 452) and 2015 (*mean* = 458). To emphasize, in all comparisons across disciplines and years, there is no practical significance between groups. The estimation

and standard errors of the standardized scores for students' achievements in science and mathematics were also presented in Table 3.

Inferential Statistics

Trends in Students Career Aspirations in Science and Mathematics

Chi-square tests were performed to investigate the differences in middle school students' science and mathematics career aspirations between 2011 and 2015 by considering sampling weights. The analyses were conducted by the complex samples module of SPSSS. Since IBM SPSS Statistics (2020) suggested reporting adjusted F and its degree of freedom, they were considered while investigating the results. Regarding science career aspiration, the results suggest significant difference with small effect between 2011 and 2015 for both girls (F [1, 6356] = 96.144, $p < .01$, $d = .31$) and boys (F [1, 9772] = 46.541, $p < .01$, $d = .20$). On the other hand, the effect of year on students' mathematics career aspiration was statistically significant but practically not significant for both girls (F [1, 6356] = 10.172 $p < .01$, $d = .11$) and boys (F[1, 9772] = 11.260, $p < .01$, $d = .10$).

Relationship between Girls' SES, Motivation, Performance and the Likelihood of Their Career Aspirations in Science in 2011 and in 2015

Binary logistic regressions were conducted to investigate how the combination of independent variables predict students' career aspirations. To evaluate the models' effect size Mcfadden ρ^2 was considered. Mcfadden ρ^2 between .20 to .40 refers to a good fit model (Tabachnick & Fidell, 2013). While investigating independent variables' impact, the Bonferroni defined alpha level, .008 (.05/6) was used to reduce type 1 error (Pallant, 2001). Additionally, to investigate the practical significance of independent variables, odd ratio values were converted to Cohen's d (Chinn, 2000). Cohen (1988) suggested lower limits of d value as follows: .20 for small effect, .50 for moderate effect and .80 for large effect.

The first binary logistic regression was conducted to investigate the effects of SES, science motivation, and science performance on the likelihood of middle school girls' science career aspiration in 2011. The model explained 36% (*Nagelkerke* R^2) of the variance and a good fit (Mcfadden $\rho^2 = .25$). According to the model, SES and science achievement were non-significant. While all the motivational variables contributed positively and significantly, students' engagement negatively and significantly contributed to explaining students' science career aspirations. The highest contribution belongs to the students' utility value beliefs ($d = .83$). Self-efficacy beliefs had a small effect ($d = .22$). Although intrinsic value was statistically significant, the effect size was very small to be considered ($d < .20$). The second binary logistic regression was performed to investigate the effects of SES, science motivation and science performance on the likelihood of middle school girls' science career aspiration

in 2015. The model explained 47% (*Nagelkerke* R^2) of the variance and a good fit (Mcfadden ρ^2 = .32). According to the results, SES and all the motivational variables contribute positively to the model. On the other hand, achievement showed a negative, significant effect on students' career aspiration in science. Similar to the 2011 results, utility value was the most accurate predictor for the model (d = 1.03) while intrinsic value didn't have significant practical effect (d = .17). Table 4 presents beta values, odd ratios and Cohen's d for the models.

Table 4

Logistic Regression Results for Girls' Career Aspiration in Science

	2011			2015		
	b (SE)	Odds ratio	Cohen's d	b (SE)	Odds ratio	Cohen's d
SES						
Home educational resources	.08 (.10)	1.08	.04	.207 (.06)*	1.23	.11
Motivational variables						
Science Self-efficacy	.391 (.07)*	1.48	.22	.388 (.08)*	1.47	.21
Science Utility value	1.509 (.09)*	4.52	.83	1.871 (.11)*	6.49	1.03
Science Intrinsic value	.309 (.07)*	1.36	.16	.297 (.09)*	1.35	.17
Performance-related variables						
Science achievement	-.04 (.06)	.96	.05	-.246 (.06)*	.78	.14
Science Engagement	-.184 (.07)*	.83	.10	-.062 .(08)	.94	.03
R^2		.37			.47	
Mcfadden ρ^2		.25			.32	

*$p < 0.5$

Relationship Between Boys' SES, Motivation, Performance and The Likelihood of Their Career Aspiration in Science in 2011 and in 2015

A binary logistic regression was conducted to investigate the effects of SES, science motivation and science performance on the likelihood of middle school boys' science career aspirations in 2011. The model explained 36% (*Nagelkerke* R^2) of the variance and a good fit (*Mcfadden* $\rho 2$ = .24). According to the model, SES was not a significant predictor for boys' career aspirations. All the motivational variables except intrinsic value were significantly and positively contributed to the model. From performance variables, while science engagement had no significant contribution, science achievement had a negative and significant effect on students' career aspirations. Regarding practical significance, utility value had large (d = .73), and self-efficacy had small effect size. The second binary logistic regression was performed to test the model

with 2015 data. The model explained 52% of the variance (*Mcfadden ρ2* = .36). According to the model SES didn't make any significant contribution on boys' science career aspiration. Besides, all of the motivational variables were positively contributed to the model. Moreover, while engagement was not significant, science achievement was negatively and significantly related to boys' career aspirations. In terms of practical significance, only utility had significant and large effect size (*d* = 1.12). The beta values, odd ratios and Cohen's *d* are presented in Table 5.

Table 5

Logistic Regression Results for Boys' Career Aspiration in Science

	2011			2015		
	b (SE)	Odds ratio	Cohen's d	b (SE)	Odds ratio	Cohen's d
SES						
Home educational resources	.107 (.05)	1.11	.05	.113 (.05)	1.20	.10
Motivational variables						
Science Self-efficacy	.435 (.07)*	1.54	.24	.287 (.08)*	1.31	.15
Science Utility value	1.324 (.08)*	3.76	.73	2.020 (.64)*	7.54	1.12
Science Intrinsic value	.087 (.07)	1.09	.05	.307 (.06)*	1.36	.17
Performance-related variables						
Science achievement	-.259 (.06) *	.77	.14	-.347 (.05)*	.71	.19
Science Engagement	-.003 (.07)	.99	.005	.067 (.05)	1.07	.04
R^2		.36			.52	
Mcfadden ρ^2		.24			.36	

*$p < 0.5$

Relationship Between Girls' SES, Motivation, Performance and The Likelihood Their Career Aspirations in Mathematics in 2011 and in 2015

Binary logistic regressions were conducted to investigate the effects of SES, mathematics motivation and mathematics performance on the likelihood of middle school girls' mathematics career aspirations in 2011 and in 2015 separately. The model explained .30% (*Nagelkerke R^2)* of the variance in 2011 (Mcfadden *ρ2* = .21), and .37 of the variance in 2015 (Mcfadden *ρ2* = .26). According to the models, while there was a positive relation between SES and career aspirations in 2015, it lost significance in 2015. Moreover, in both 2011 and in 2015, utility value had significant and moderate impact, self-efficacy and intrinsic value had significant and small effect. Besides, mathematics engagement was non-significant for both of the models. Among

performance-related variables, achievement was not practical significant (d = .16). Table 6 presents beta values, odd ratios and Cohen's d for the models.

Table 6

Logistic Regression Results for Girls' Career Aspirations in Mathematics

	2011			2015		
	b (SE)	Odds ratio	Cohen's d	b (SE)	Odds ratio	Cohen's d
SES						
Home educational resources	.132 (.06)*	1.76	.31	.101 (.06)	1.11	.06
Motivational variables						
Science Self-efficacy	.695 (.09)*	2.00	.38	.604 (.10)*	1.83	.33
Science Utility value	.944 (.11)*	2.57	.52	1.120 (.13)*	3.06	.62
Science Intrinsic value	.377 (.08)*	1.46	.21	.594 (.08)*	1.81	.33
Performance-related variables						
Science achievement	-.281 (.07)*	.75	.16	-.187 (.08)	.83	.10
Science Engagement	.005 (.07)	1.01	.05	-.039 (.08)	.96	.02
R^2		.30			.37	
Mcfadden ρ^2		.21			.26	

*$p < 0.5$

Relationship Between Boys' SES, Motivation, Performance and The Likelihood of Their Career Aspirations in Mathematics in 2011 and in 2015

Binary logistic regressions were conducted to investigate the effects of SES, mathematics motivation and mathematics performance on the likelihood of middle school boys' mathematics career aspirations in 2011 and in 2015 separately. The model explained .29% (*Nagelkerke* R^2) of the variance in 2011 (Mcfadden $\rho 2$ = .20), and .38 of the variance in 2015 (Mcfadden $\rho 2$ = .25). According to the models, there was no significant effect of SES on the model of 2011. Although it was significant in 2015, the effect size was too small to consider (d = .11). Moreover, in both 2011 and in 2015, self-efficacy had significant positive relation with small effect size. Regarding students' value beliefs, utility value had moderate effect for both years, while intrinsic value was not statistically significant in 2011 and had become significant with small effect size in 2015. Besides, mathematics engagement was non-significant, while mathematics achievement had a negative and significant impact regarding boys' career aspirations in mathematics. It may be a suppressor phenomenon to have a negative contribution to the model. Namely, having high correlation with other variables and low correlation with students' career interests may have caused suppressor phenomenon to occur (Pandey &

Elliot, 2010). Hence, this does not mean that students who are underachieved tend to be more willing to have a science career than the others. Table 7 presents beta values, odd ratios and Cohen's d for the models.

Table 7

Logistic Regression Results for Boys' Career Aspirations in Mathematics

	2011			2015		
	b (SE)	Odds ratio	Cohen's d	b (SE)	Odds ratio	Cohen's d
SES						
Home educational resources	.071 (.05)	1.83	.33	.115 (.04)*	1.22	.11
Motivational variables						
Science Self-efficacy	.716 (.07)*	2.05	.40	.490 (.06)*	1.63	.27
Science Utility value	.886 (.07)*	2.43	.49	1.314 (.08)*	3.72	.72
Science Intrinsic value	.261 (.07)*	1.30	.14	.450 (.06)*	1.57	.25
Performance-related variables						
Science achievement	-.349 (.06)*	.61	.27	-.451 (.05)*	.64	.25
Science Engagement	-.004 (.06)	.99	.05	-001 (.05)	.99	.05
R^2		.29			.38	
Mcfadden ρ^2		.20			.25	

*$p < 0.5$

Discussion

The purpose of this study was to examine girls' and boys' career aspirations in science and mathematics between 2011 and 2015. Also, another aimed study was to investigate how SES and motivational and performance related variables affect boys' and girls' career aspiration in science and mathematics in the years 2011 and 2015. The combination of the variables that are the number of books, parents' educational level and home study support were handled as SES variables. Students' task value beliefs (utility value and intrinsic value) and self-efficacy beliefs were investigated as motivational beliefs. Finally, performance related variables were represented as students' engagement and academic achievement.

Trends in Students' Career Aspirations in Science and Mathematics

Regarding year differences of middle school students' career aspirations in science and mathematics, the analyses showed that while there were no practical differences between 2011 and 2015 for mathematics career aspiration, there is an increment on

students' career aspirations in science from 2011 to 2015, even though it has a small effect. The reason x middle school students tend to pursue a career in science in 2015 more than they did in 2011 can be the educational system of Turkey. In 2013, there was a science curriculum revision which aimed to enhance middle school students' knowledge about careers related to STEM and career introductions had started to take a part of the science programs (MoNE, 2013). As mentioned before, lack of knowledge about x careers can cause lack of interest in those careers (Blotnicky et al., 2018). For instance, Wyss and her colleagues (2012) investigated the effect of videos about scientists on students' career aspirations and observed that students tend to aspire to a science-related career more than they do before experiment. Hence introducing some occupations to middle school students after the 2013 reform may increase their awareness and may draw their attention to careers related to science or mathematics.

Links between SES and Career Aspiration

To investigate underlying reasons for girls' and boys' career aspirations in science and mathematics, students' SES, motivational beliefs and their performance-related behaviors were tested with logistic regression analyses. According to the models, the SES had not significantly contributed to students' career aspirations in all models except the model of 2011 mathematics for girls. Although Turkey is a developing country, there is still gender inequality in terms of accessing education especially amongst the low SES families (Caner et al., 2016). For instance, Tunç (2009) investigated girls' education in a low SES city. The researcher suggests that families tended to withdraw their support for female students on their ongoing education, whereas they encourage boys for education in previous years so SES became significant for girls. In 2015, SES lost significance also for girls. In other words, low-SES students and high-SES students had the desire to have a job related to mathematics or science equally. According to the findings, the gap between girls from different SES statutes became narrower in 2015 for science career aspiration. In Turkey, science or mathematics-related careers, in other words STEM careers, are believed to provide more financial advantages than other occupations (Bahar & Adıgüzel, 2016). Hence, boys from high SES families and from low SES families may be supported equally to go to a college and to pursue a STEM-related career. Supporting this idea, Correll (2001) suggested that students from low SES families tend to choose STEM careers due to the idea of possibility of having a higher financial income.

Links between Motivational Beliefs and Career Aspiration

The results of the present study confirmed the expectancy-value theory's suggestion which claims students' motivational beliefs directly influence their academic and future choices (e.g., Wigfield & Eccles, 2002). According to the findings, utility value was the common and the strongest variable to predict students' aspirations for a career related to science and mathematics. It had a moderate or large effect on girls' and boys' career aspirations. This means that students, both girls and boys who believe that science or

mathematics will be helpful for their life tend to aspire to a career in science or mathematics. This was an expected result since the theory suggests that individuals' motivational beliefs have prominent roles on their career aspirations (Eccles et al., 1983). The relevant research also supports this idea (Ahmed & Mudrey, 2019; Laurmann et al., 2017). In addition to that, when we compare the odd ratio of utility value beliefs, its contribution was increased not only for science, but also for mathematics, which means, in 2015 boys' beliefs about tasks' utility explained their career aspirations more than they did in 2011. On the other hand, the relations were a bit complicated for intrinsic value and self-efficacy. Intrinsic value had a significant effect on students' science career aspirations neither for girls nor boys. Namely, finding science tasks enjoyable did not predict students' pursuing a career related to science. Regarding mathematics, it predicted girls' career aspirations in 2011 and 2015 with a small effect size. It became significant for boys only in the 2015 mathematics model. Besides that, students' self-efficacy had a small effect on all the models except predicting boys' science career aspiration in 2015. To summarize, self-efficacy and utility value were significant while predicting girls' science career aspirations. In the mathematics model, intrinsic value did stand out. It was included in the model, and all motivational variables together predicted girls' mathematics-related career aspirations significantly. In respect to boys' career aspirations, while self-efficacy and utility value had contributed to the model of 2011 science, in 2015, self-efficacy lost its significance and utility value became the only variable that significantly predicted boys' science career aspirations. Since the theory emphasizes the motivational, both efficacy and value, beliefs' importance for individuals' achievement-related choices (Eccles et al., 1983), it was surprising that intrinsic value didn't contribute to boys' and girls' science career aspirations and self-efficacy lost their contribution in 2015 science model for boys. One of the reasons for this unexpected finding may have been caused by medical careers. Being a medical doctor is one of the most popular careers among adolescents (Sikora & Pokropek, 2011). For instance, Yerdelen et al. (2016) investigated middle school students' career plan profiles and suggested that many of the participants reported that they wanted to be a doctor. Being a medical doctor is not only popular for students, but parents also want their child to choose to be a doctor in the future ("Ailelerin meslek tercihi" [Occupation preference of parents], 2013). This popularity can encourage girls to aspire to a science-related career even though they do not find science enjoyable. Supporting this idea, in a recent study Koşan et al. (2020) investigated medical students' thoughts about their career and suggests that the advantages of being a doctor, such as prestige or high income, become prominent for students. In a further study, this concern should be investigated.

Links between Performance-related Behaviors and Career Aspiration

The results of the current study suggest no significant relation between student engagement and their career aspirations for both girls and boys. In fact, prior results about the relation between student engagement and their career aspirations were also inconsistent. While some suggested that engagement affects students' choices positively (e.g., Wang & Degol, 2014), others suggest it does not significantly affect career

aspiration (e.g., Kenny et al., 2006). The reason for this unexpected result might have been caused by the Turkish educational system. Although the Ministry of National Education of Turkey made a revision and the modified curriculum is based on constructivism which emphasizes student-centered instruction, students still receive teacher-centered instruction (Cetin-Dindar, 2016). Student-centered learning environments positively affect students' motivation and attitudes (Dorman, 2001). That's why experiencing traditional learning environments may have no effect on students' aspirations of having a career in science or mathematics x in their future life. Supporting this idea, Kang and Keinonen (2017) investigated the effect of inquiry-based learning experiences on students' career aspirations in science and suggested positive relation between these variables. In another study, Ma and Wang (2001) examined students' career aspirations in a model and they included the model quality and quantity of the instruction. According to the findings, the quality of the instruction was more important than the quantity of instruction, and it had indirect effects on students' career aspirations. Indeed, the possibility of indirect relation should also be considered while discussing the engagement career aspiration relation. Student engagement may affect their pursuit of a career related to science or mathematics over motivation. Besides, in the present study, only one dimension of engagement is investigated. In a further study, engagement can be investigated as a multidimensional form, and the indirect relations can be examined. Achievement was also handled as a performance-related variable in this study. According to the findings, achievement was significant only in mathematics career aspirations for boys. It contributed to girls' career aspirations neither in mathematics nor in science. Due to this solid fact, the reason cannot be that the girls are low achievers. Actually, in accordance with this finding, previous research suggests that although the gender gap in achievement decreased between girls and boys, females are still underrepresented in STEM-related careers (Ceci & Williams, 2010). In a similar way, motivation became prominent while predicting girls' mathematics career aspirations in the findings of this study.

Conclusions

The current study examined a) middle school girls' and boys' desire to have a career related to mathematics or science, and b) antecedents' career aspirations in science and mathematics for boys and girls. The main purpose was to compare boys' and girls' underlying reasons of career aspirations based on expectancy-value theory. According to the findings, the common and strongest predictor was utility value. In each model, it contributed a moderate or large effect on students' career aspirations for both science and mathematics. In fact, it was the only significant predictor of boys' science career aspirations in science in 2015. Compared to the models of 2011, utility value increased its effect on predicting students' career aspirations. Interestingly, intrinsic value was not significant for boys and girls in predicting their scientific career aspirations. It was an unexpected finding and should be investigated in detail in a further study. The main difference between boys' and girls' models is that achievement was only significant for boys. Except for this, the models were similar for boys and girls. This study has some

limitations. Firstly, the design of the study was the combination of causal-comparative and correlational research since it does not aim to build a cause-and-effect relationship among variables. Additionally, students' engagement was investigated as only behavioral engagement. The other aspects of engagement could not be included in the study. Hence, in a further study, researchers can investigate students' engagement and career aspirations taking all aspects of engagement into consideration.

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Kız ve Erkek Öğrencilerin Fen ve Matematik ile İlgili Kariyer İsteklerindeki Eğilimler

Öz

Bu çalışmanın amacı ortaokul öğrencilerinin, 2011 ve 2015 yılarında, fen ve matematik ile ilgili kariyer yapma isteklerini cinsiyet farklılığını göz önünde alarak incelemek ve öğrencilerin sosyoekonomik durumu, motivasyonu ve performans ile ilgili değişkenlerin kız ve erkeke öğrencilerin fen ve matematik alanlarda kariyer yapma isteğini nasıl tahmin ettiğini incelemektir. Evdeki kitap sayısı, çalışma ortamı ve anne-babanın eğitim seviyesi sosyoekonomik durum göstergesi olarak kabul edilmiştir. Motivasyon değişkenleri öz-yeterlik ve değer verme olarak ele alınırken, öğrenci performansı ile ilgili değişkenler başarı ve katılım olarak ele alınmıştır. Bu çalışmada, TIMSS 2011 ve 2015 verisi kullanılmıştır. Kız ve erkek öğrencilerin fen ve matematik ile ilgili kariyer yapma isteklerindeki yıl farklılığını incelemek için Ki-kare testi yapılmıştır. Ayrıca, kız ve erkeklerin 2011 ve 2015 teki SES, motivasyon, performans değişkenleri ve kariyer yapma isteği arasındaki ilişkiyi incelemek için her yıl verisi ile ayrı ayrı lojistik regresyon analizleri yapılmıştır. Bulgulara göre, motivasyon, kız ve erkek öğrencilerin kariyer yapma isteğini tahmin etmede en güçlü ve ortak değişkendir.

Anahtar sözcükler: kariyer yapma isteği, fen, matematik, TIMSS

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University Students' Positive and Negative Perceptions of Lifelong Learning: A Metaphoric Analysis

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Abstract

In tertiary education, lifelong learning (LL) skills alongside technical skills need to be prioritized. Is it, however, correct to assume that all university students are familiar with LL? Even so, might some students believe that LL is a source of tension? One way to understand these aspects is through metaphors, commonly used to convey the meaning individuals attach to concepts. Thus, this study investigated 229 university students' metaphoric perceptions of LL. Data were collected using a discourse completion task. Results revealed that the students had limited understanding of LL as reflected through their chosen metaphors. The metaphors most frequently used to define LL were "tree," "life," "universe" and "trip." The students' explanations pointed to a variety of attributes of LL, "continuity," "limitlessness," and "expansion of horizons" being the most frequent ones. There were also metaphors and attributes denoting negative perceptions. We recommend LL skills be made an integral part of curricula to enhance students' potential for becoming lifelong learners.

Keywords: lifelong learning, lifelong learner, metaphor, student perceptions, tertiary education

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Introduction

Hardly a day passes when we do not hear the slogan "Education is a must!" expressed with the sentiment that it is through education that we acquire values, knowledge, and skills essential for success in life. However, what is often overlooked is the concept of learning, which can be defined as "the lifelong process of transforming information and experience into knowledge, skills, behaviours and attitudes" (Cobb, 2021, para. 2). Approached from this perspective, learning includes education and takes place throughout life, encompassing all forms of learning, both job related and non-job related, within and beyond formal education.

Learning is inevitable and may be prompted by a variety of factors, one of which is changes we experience throughout our lifespans. Also, due to our endless potential for technological and cultural development, learning across the whole of our

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lifespans is inevitable (London, 2011). For it to be utilized fully though, this potential should not be left to chance; the constant commitment to learning again and throughout life ought to be imparted to students during the years of formal education. Only in this way can they be prepared for the need and the desire to continue their learning beyond school. Therefore, it becomes incumbent on educational institutions to provide students with the opportunity to acquire the skills in lifelong learning (LL).

The extent to which students are involved in LL experiences determines how likely they are to improve their LL skills. It is, however, essential to start with where students are (Deveci, 2014). That is, students with a predominantly authoritarian educational background may not have an inclination for LL. Far worse, they may consider LL to be an inhibitor. The concept may not even exist in their tacit knowledge. One way to determine their perceptions is through metaphors, which we further discuss below.

With these points in mind, we wanted to investigate our university students' perceptions of LL reflected through metaphors. Given our professional background and teaching experience in engineering institutions, as well as based on the convenience factor, we focused on engineering students; however, the concepts we define below, as well as the results yielded by our study might as well be relevant to other disciplines in different geographical locations.

Lifelong Learning and Lifelong Learners

The European Commission (2001) provides a traditional definition of LL: "all learning activity undertaken throughout life, with the aim of improving knowledge, skills and competences within a personal, civic, social and/or employment-related perspective" (p. 9). As is clearly indicated in this definition, LL is not limited to learning related to one's profession; it is geared towards individuals' holistic development in all spheres of life, including schools, workplaces, society, and the family (Bozkurt & Ucar, 2021). Although it includes formal learning taking place in education institutions, Hager (2021) cautions that too much focus on formal learning hinders deeper understanding of LL and argues that the role of informal learning in LL should also be given prominence. He characterizes LL as essentially informal, while others believe LL covers all kinds of informal learning (Kraiger et al., 2021) in addition to any other types of learning, including formal, non-formal, continuing, and workplace. In support of these arguments, Kenny (2019) posits that informal learning is "the oxygen of a lifelong learning society" (para. 15).

The European Council (2012) defines informal learning as "learning resulting from daily activities related to work, family or leisure and is not organized or structured in terms of objectives, time or learning support" (p. 5). A similar definition is provided by Livingstone (2006): "all forms of intentional or tacit learning in which we engage either individually or collectively without direct reliance on a teacher or externally organized curriculum" (p. 204). Inherent in these definitions is the idea that learning is

an intrinsic part of life, can be intentional or tacit, is undertaken individually or in collaboration with others under or without the supervision of a mediator. Learning can be related to one's profession or personal life/interests, as is emphasized in the above-mentioned definition of LL by the European Commission (2001).

There have also been discussions held widely related to the qualities of lifelong learners. Based on data from faculty, administrators, and advisors, Love (2011, p. 158), for example, identifies a variety of qualities of a lifelong learner, most of which are job-related. These are as follows:

a) taking responsibility for planning his professional career path;
b) understanding the role of professional organizations in LL;
c) seeking certifications associated with his profession;
d) self-assessing, asking others to assess him, reflecting and taking learning action based on assessment and reflection;
e) remaining current in his field and taking responsibility for identification of knowledge deficiencies and learning opportunities;
f) knowing criteria that will be used to evaluate performance and professionalism,
g) having a multiyear professional development plan, and
h) having learning interests outside his profession and pursuing those with vigor.

Adopting a wider perspective, Qinhua et al. (2016, pp. 6-7) identify the following qualities as essential for one to be a lifelong learner:

a) acknowledging the theory and value of lifelong learning;
b) strong desire and motivation to learn, coupled with a sense of responsibility;
c) clear self-perception, in addition to continual self-reflection and self-assessment;
d) sefl-direction, self-adjustment, and control of one's learning process;
e) skills in using learning methods, strategies, approaches and reseources of all kinds to assist their learning, and
f) ability to assess the effects of their learning and use what they have learned in the process of solving problems and facilitation of further learning in the future.

On the other hand, Duman (2007) approaches the concept from the perspective of *knowledge literacy* and states lifelong learners are knowledge-literate people who

a) accept the fact that knowledge is the key to making informed decisions,
b) know how much knowledge they need as well as when and where they need it,
c) define the kind of knowledge necessary to solve a problem through the question-and-answer technique,
d) define and locate potential sources of knowledge,
e) evaluate the usefulness and accuracy of the knowledge they acquire in terms of its relevance to the problem at hand,
f) organize, store, and use different kinds of information purposefully, and

g) integrate the new knowledge with the existing one, which is then used to tackle the problem at hand.

The list of attributes in the foregoing points to the direction towards which tertiary education needs to be geared. Without readiness for learning throughout their lifespans, students will be at a significant disadvantage in their attempt to come to terms with the exigencies of their professional and personal lives. Successful engagement in LL is as much a requirement for professional development as it is a requisite for holistic growth. Thus, it is impossible to restrict LL skills to the professional sphere per se, which is also explicitly stated in Love's (2011) list of the characteristics of a lifelong learner. The development of university students' LL skills will be, therefore, in tandem with the developments in their professional and personal lives. Thus, faculty's contribution to students' academic skills through LL training will have far-reaching impacts beyond formal education. So much so that "Learning in all parts of an individual's life course is essentially an unbounded activity, one which frequently takes place beyond institutions — this is especially the case in the twenty-first century where information technologies enable individuals and groups to freely access existing (and create new) knowledge" (Fisher et al., 2019, pp. 8-9).

Lifelong Learning and Engineering Education

We can surmise that by the time they start their tertiary education, students have formed a certain attitude toward learning, which may or may not be compatible with LL. Therefore, it is important that universities pay explicit attention to discipline-specific as well as generic LL skills, such as personal and interpersonal skills, problem-solving, cultural understanding, and planning and organizing activities (Yeung et al., 2007). In support of this, the Accreditation Board for Engineering and Technology (ABET) (2017) mandates that engineering programs develop students' recognition of the need for, and an ability to engage in, LL. A robust range of studies also supports the contention that LL must be an intrinsic part of engineering education just as it is of other disciplines. For instance, pertaining to a civil engineer in particular, Latinopoulos (2005) notes

> In our days a civil engineer is not only a designer, a planner or a constructor. He is also a producer, a decision-maker and most probably a leader. In order to succeed in such a multiform of professional tasks, the civil engineer should constantly acquire a planned combination of knowledge, experience and skills, as well as develop his individual qualities and competences. (p. 121)

On the other hand, Peat et al. (2005) emphasize the importance of LL across engineering curricula, noting that a separate course on LL would be inadequate. Engineering departments, according to them, need to adopt a multidisciplinary approach to learning and teaching, enabling students to develop a strong aptitude for LL.

In order to become lifelong learners, engineering students ought to have certain soft skills alongside hard skills. Taylan and Bafail (2019) note that soft skills essential for engineering students include analytical thinking, verbal and written communication, and leadership skills. Soft skills also consist of mindfulness of the rights of others and respect to others. All these facilitate human connections, which assists in building relationships, gaining visibility, and creating opportunities for advancement.

The above-mentioned idea of 'mindfulness of the rights of others' is also emphasized by ABET (2007) via its reference to *ethical responsibility* as a key soft skill, which requires engagement in effective intrapersonal communication, an aspect of which is emotional intelligence. Considering Neil Armstrong's note in the foreword of "A Century of Innovation: Twenty Engineering Achievements That Changed Our Lives" by Constable and Somerville (2003) that engineers' main responsibility is to improve the quality of people's lives by providing solutions to societal needs, engineers need to be cognizant of societal needs. This cannot be achieved without the ability to empathize (Deveci & Nunn, 2018). It requires students to engage in continuous learning of changes to people's lives triggered by technological, economic, and political developments. Awareness of these points is the role of LL, not only in students' own lives but also in the lives of others, which brings an additional layer to the meaning of LL.

Metaphoric Perceptions of Lifelong Learning

The word metaphor is defined in the Merriam-Webster's online dictionary as "a figure of speech in which a word or phrase literally denoting one kind of object or idea is used in place of another to suggest a likeness" (n.d.). Similarly, Ritchie (2013) defines the word as "seeing, experiencing, or talking about something in terms of something else" (p. 8).

Lakoff and Johnson (1980) state that metaphors are an expression of thought structures and "our ordinary conceptual system, in terms of which we both think and act, is fundamentally metaphoric in nature" (p. 3). Not only do our metaphoric conceptual systems govern our thoughts, but they also impact our everyday functioning. Accordingly, the analysis of students' conceptual systems of learning displayed through the metaphors by which they live can provide insights into their perceptions of LL affecting their (dis)engagement in learning endeavors related to their professional and personal lives. Their metaphoric perceptions of LL can be a useful predictor of LL skills they either possess or need to improve. These would enable faculty and university administrators to refrain from introducing educational practices in an *ad hoc* way. These would also assist in designing and executing educational interventions that support the notion of learning as "a lifelong process of transforming information and experience into knowledge, skills, behaviours and attitudes" (Cobb, 2021, para. 2).

There has been some research into participants' metaphoric perceptions of LL in a few disciplines. These include nursing and nursing education (Şenyuva & Çalışkan,

2014; Şenyuva & Kaya, 2013) and teacher education (Gultekin & Aricioglu, 2017; Mudra & Aini, 2020; Sezer, 2018). There is also some research conducted into engineering students' metaphoric perceptions of concepts such as science and technology (Sadoglu, 2018). In addition, Boz (2020) studied civil engineering students' metaphoric perceptions of adult education. Although his study provides insights into civil engineering students' thoughts on adult education, the concept of LL is more comprehensive than adult education. The most significant difference stems from the very definition of the concept of education, which can be defined as an activity "undertaken or initiated by one or more agents that is designed to effect changes in the knowledge, skill, and attitudes of individuals, groups, or communities" (Knowles et al., 2005, p. 10). What is inherent in the meaning is that "education emphasizes the provider of knowledge and skills. In contrast, learning emphasizes the recipient of knowledge and skills and the person(s) in whom a change is expected to occur" (Stanhope & Lancaster, 2012, p, 353). Hence, LL denotes "the development of human potential through a continuously supportive process which stimulates and empowers individuals to acquire all the knowledge, values, skills, and understanding they will require throughout their lifetimes and to apply them with confidence, creativity and enjoyment in all roles, circumstances, and environments" (Longworth & Davies, 2013, p. 22). On this account, LL potentially encompasses all forms of learning, whether formal, informal, or incidental, and whether by adults, the elderly, or children. Against this backdrop, not only do individuals' perceptions of LL affect their skills and engagement in learning throughout life but they also impact the learning experiences of those with whom they are in close contact, e.g., their family members, colleagues, peers, and instructors. The latter is of particular importance considering the role of interpersonal communication skills in the enhancement of LL skills (Deveci, 2019). Indeed, the eight key LL competencies identified by the European Council in 2006 point to the place of interpersonal communication. The third competence, closely linked to engineering education, is related to science and technology, requiring the acquisition and application of knowledge and methodology to address society's needs. This accords with Lieb-Brilhart's (1978, p. 140) contention that "The overall goal of the [LL] learning movement is that all of us participate fully in and contribute to society throughout our lives." Intrinsic to this argument is the connectedness of individuals in society, whose LL skills are inextricably linked to one another.

Research Question

By examining their metaphoric conceptual systems pertaining to LL, important insights can be gained into students' knowledge and interest in LL. To this end, this research asked the following question:

> What are students' metaphoric perceptions of LL?

Method

Code of Ethics

Written permission was obtained from Dicle University administration for data collection with the number E-26452168 -100-1197 on 08.01.2021. All the participants took part in the study on a voluntary basis, and their identity was kept confidential.

Participants

Adopting the convenience sampling method, the data for this study were collected from 229 undergraduate civil engineering students at a Turkey-based university where the second author of the current paper is employed. Of this number, 159 were male and 70 were female. The students' ages ranged from 18 to 47, with a mean age of 24. The group consisted of 22 freshmen, 100 were sophomores, 42 juniors, and 65 senior students.

Data Collection and Analysis

The data were collected using a discourse-completion task. The students were first given the dictionary meaning of metaphor followed by two examples and possible explanations for the metaphor used in the examples. They were then asked to complete the statement "To me, lifelong learning is …". After this, they were asked to explain their reasons for the choice of that particular metaphor. To this end, they completed the sentence, "This is because …" They were given ample space in which to write their responses without a restriction on the number of words.

Based on the previous research (Boz, 2020; Mudra & Aini, 2020; Şenyuva & Caliskan, 2014), we followed a series of stages for data analysis. In the first stage, we checked whether the students used a metaphor or not. Fifteen of the students did not use a metaphor or did not explain the metaphor they generated. As this indicated a lack of understanding of the task, these students' responses were excluded from the data set. We also noted that 34 students used a simile instead of a metaphor in their responses. While the former involves "a comparison that uses *like* or *as*, or a related word," the latter involves "a comparison that shows that two things are alike by making it sound as if they are the same thing" (Stefoff, 2018, p. 5). Yet both are figures of speech using different types of analogies. It is also important to note that previous researchers (e.g., Boz, 2020) collected data on participants' metaphoric perceptions through similes. Accordingly, those students' responses in the current study were maintained in the data set. In the second stage, we put the metaphors in alphabetical order so we could identify the frequency of each metaphor used. In the third stage, we analyzed the justifications provided by the students and put them into categories according to the particular attributes denoted by each metaphor. Since different metaphors were used to denote particular attributes, we then matched the attributes with their accompanying metaphors.

When analyzing the attributes, we noticed that some students used positive and negative connotations, which we grouped separately.

For inter-coder reliability purposes, upon a standardization session, we — as the two researchers — conducted the qualitative data analysis separately. The analysis results were then compared. An initial agreement rate of 84% was achieved. We discussed the divergences until agreement was reached. The items not agreed upon were excluded from the data set.

Results

This research aimed to identify university students' metaphoric perceptions of LL. The data included the metaphors they used as well as their explanations of the metaphors. Table 1 lists the metaphors and the frequency with which they were used.

Table 1

Metaphors

Metaphors	#*	#**	%
1. tree	17	17	8.1
2. life	12	12	5.7
3. universe, trip	10	20	9.5
4. baby, book, water	9	27	12.8
5. treasure	8	8	3.8
6. breath, ocean	6	12	5.7
7. food, experience	5	10	4.7
8. hunger for knowledge, library, stairs, innovation, iron, sea, *war*	3	21	10
9. the brain, bottomless well, youth, the sun, the world of science, ant, bird, technology, competition, school, star, wisdom, seed, sleep, door	2	30	14.2
10. wealth, a new page, pillow, *cannibalism*, petrol station, vitamin, rebirth, ever expanding borders, song, *artist*, cake, *paradox*, antivenom, maturity, happiness, grease, butterfly, determination, promotion, money at the end of stormy sea, storehouse, a smart suit, *electric shock*, a person young forever, heavenly gift, *dope*, soul, boomerang, a plant root searching for water, learning to ride a bike, cement, *barrier*, driving a car, trainer, encyclopedia, parent, stream, transformation, *labor*, energy, day and night, future, rainbow, shadow, help in the hour of need, will power, light, snow ball, income, *black hole*, ripe fruit, river, *exam*, continuity	1	54	25.6
Total		211	100

* Delineates each metaphor separately
** Delineates the total number of metaphors in the category

Of the total number of 91 metaphors produced by the students, the most frequent one was "tree" (f = 17), accounting for 8.1 % of all the metaphors. This was followed by "life" (f = 12, 5.7 %). The third most frequent ones were "universe" and "trip," each of which was used 10 times. Together, these accounted for 9.5 % of all the metaphors. The metaphors of "baby," "book," and "water" were each produced nine times and together they accounted for 12.8 % of the data set. "Treasure" was in the fifth place (f = 8, 3.8 %). "Breath" and "ocean" shared the sixth place (f = 12, 5.7%), "food" and "experience" the seventh place (f = 10, 4.7 %) and "hunger for knowledge," "library," "stairs," "innovation," "iron," "sea," and "war" the eighth place (f = 21, 10%). A number of other metaphors were used twice, thus coming in the ninth place (14.2 %). Examples include "the brain," "bottomless well," "youth," "the sun," "star," and "door." A greater number of other metaphors (f = 54, 25.6 %), on the other hand, were produced only once by the students, coming in the tenth place. Sample metaphors in this category are "pillow," "cannibalism," "vitamin," "cake," "butterfly," "barrier," and "river."

It is also important to note that some of the metaphors (indicated in italics in Table 1) were given negative connotations by the students. These are: "war," "barrier," "black hole," "exam," "paradox," "labor," "electric shock," "cannibalism," "dope," and "artist." There were 11 instances of these metaphors. Together, they accounted for 5% of the metaphors set. When the students' explanations of the metaphors were analyzed, 23 attributes of LL were identified. These and their associated metaphors are given in Table 2 below.

It is seen in Table 2 that there were 18 attributes of LL with a positive connotation. The most frequent one was related to "continuity" of the concept (f = 48, 25.9%). The students used a variety of metaphors denoting this attribute (e.g., "tree," "universe," "stairs," "snowball"). Their explanations often pointed to learning being a continuous endeavor, new learning leading to new understandings, which in turn triggers engagement in new learning experiences. One of the students noted, "The most important quality of [LL] is that it never ends. Just like a tree, it strikes roots. The more it does it, the more strength it gains."

Related to continuity is the second attribute, "limitlessness," which occurred 31 times in student explanations (16.8%). Among the various metaphors denoting this was "universe," "ocean," "bird," and "stars." The students often stated that LL has no end. Some noted that it lasted from the cradle to the grave. They indicated there is no limit to knowledge in the world as there is no end to the universe. For example, one student said, "There is no end to the number of things you can learn. No matter how much you learn, there will always be things you are yet to learn."

"Expansion of horizons" as an attribute came in the third place (f = 25, 13.5%). The metaphors, such as "book," "library," and "school" were used to describe how LL contributes to people's professional and personal development. One of the students expressed this sentiment saying, "As we engage in learning throughout life, we fill in the blank pages of a book. This expands our horizons, and we look at the world through new lenses."

Another attribute found in the data set was "meaning of life," which occurred in 15 explanations (8.1%). The students used "breath," "water," and "the sun" as metaphors pointing to the nature of LL as part of the fabric of life. Without these, they said, life would not be possible. The metaphor of "baby," on the other hand, was used to indicate that LL gives meaning to life just like a newborn baby, so much so that being a parent has a life-changing effect on one's outlook on life.

Table 2

Attributes of LL and Their Associated Metaphors

Attributes of LL*	f	%	Associated Metaphors
Positive Connotations			
continuity	48	25.9	tree, universe, stairs, sea, seed, river, shadow, snowball, butterfly, soul, continuity, day and night, sleep
limitlessness	31	16.8	universe, ocean, sea, the sun, bottomless well, star, bird, ever expanding borders
expansion of horizons	25	13.5	book, experience, library, school, encyclopedia, antivenom
meaning of life	15	8.1	breath, water, the sun, life, baby
motivation	13	7	competition, trip, song, cake, energy, grease, happiness, boomerang, a new page, petrol station, income
enhancement of world knowledge	9	4.9	light, wisdom, hunger for knowledge, door, storehouse, ripe fruit, smart suit
enhancement of occupational skills	7	3.8	innovation, technology, the world of science, iron,
preciousness	4	2.2	wealth, food, treasure, heavenly gift, breath, vitamin
strength of will	5	2.7	determination, money at the end of stormy sea, a plant root searching for water, promotion, ant, will power
comprehensiveness	3	1.6	rainbow, tree
self-fulfillment	3	1.6	maturity, transformation, future, rebirth, youth
permanence of learning	2	1.1	cement, a person young for ever
responsibility for others	2	1.1	baby, trainer
requirement of attention	2	1.1	baby, driving a car
non-stationarity	2	1.1	stream, the brain
action learning	1	0.5	help in the hour of need
learning from mistakes	1	0.5	learning to ride a bike
personal choice	1	0.5	pillow
Negative Connotations			
struggle	5	2.7	war, barrier, black hole, exam, paradox
time consumption	2	1.1	labor,
Pain	1	0.5	electric shock
excessiveness	2	1.1	cannibalism, dope
only for the skilled	1	0.5	artist
Total	185	100	

* More than one attribute was identified in some responses while some attributes were common to more than one metaphor

"Motivation" was another theme attributed to LL (*f* = 13, 7%). The students referenced metaphors such as "competition," "trip," "song," and "cake," as factors encouraging them to engage in learning throughout life. One student said just like a piece of cake, a successful learning experience leaves a good taste in the mouth making the person eat more of it. Similarly, another student noted, "[LL] is a journey with beautiful sceneries, which makes you happy and want to travel further." Likewise, "winning a competition" was noted by students to be a factor motivating the individual to participate in new competitions. For others, the enhanced knowledge and skills, thanks to LL meant an increase in their income, which was a motivating factor.

"Enhancement of world knowledge" (*f* = 9, 4.9%) and "occupational skills" (f = 7; 3.8%) were two other attributes identified in the student responses. In regard to the former, the students used metaphors such as "light," "wisdom," "door," and "ripe fruit." To them, LL was a way for enlightenment, which is gained through accumulated experience. In the words of one of the students, "We become wise thanks to our experiences throughout our lives. A wise person is one who is different from others as well as one who continues learning no matter." Similarly, to another student, "door" meant "the choice for knowledge, which makes the person comparatively wiser and therefore happier." Another student said, "[LL] is a smart suit because when it makes you look smart and intelligent." As for occupational skills, the students often referenced "technology," "science," and "innovation." They explained LL enables them to keep up with technology and brush up on hard skills when necessary.

Having occurred four times (2.2%), "preciousness" was another quality of LL. The students stated LL was "wealth" or "treasure" individuals get to enjoy through acquisition of knowledge. It was also described as "a heavenly gift", whose value cannot be measured. Similarly, it was considered as "breath" without which one cannot survive.

Less frequent though they were, "strength of will" (f = 5, 2.7%), "comprehensiveness" (f = 3, 1.6%) and "self-fulfillment" (f=3, 1.6%) were identified as attributes of LL, too. Pertaining to "strength of will", the students said LL both needs and nurtures determination. It was mentioned that just like "a plant root searching for water", a lifelong learner never gives up learning. And similar to "an ant", a lifelong learner works tirelessly investing in his/her future. As for "comprehensiveness," LL is described as "a rainbow" encompassing different colors. The student who used this metaphor explained, "Everything we learn adds color to our lives." The theme of "self-fulfillment" was expressed through the use of metaphors, including "maturity," "transformation," and "re-birth." Through these metaphors, the students expressed that LL allows individuals to realize their potential and matures them. At times, it transforms them, turning them into a new self, one that is self-actualized.

Among the other themes identified infrequently were "permanence of learning," "responsibility for others," "requirement of attention," and "non-stationarity," each of which appeared twice in the data set (1.1%). There were also attributes that occurred only once (0.5%): "action learning," "learning from mistakes," and "personal

choice." The last of these was expressed through the metaphor of "pillow." The student explained, "You can sleep without a pillow, but it is more comfortable to sleep with one."

Despite the aforementioned positive attributes, there were also attributes with negative connotations. The most frequent one was that of "struggle," which occurred five times (2.7%). The students used the metaphors of "war," "barrier," "black-hole," "exam," and "paradox" to express how they felt about the concept. To these students, LL meant continuous struggle to stay alive in the harsh work environment. The constant engagement in learning, mainly due to the "rat race" nature of the workplace, created stress in them. They also noted there is always a barrier in life that has to be eliminated. To them, LL was an obligation with negative impacts on time, which was expressed through the metaphor "labor". Having to learn throughout life meant less time spent with family members.

Another negative connotation was related to the theme of "pain", which was expressed through the use of "electric shock". This student said, "The things you learn in life can give you pain just like an electric shock". However, the student also said, "The pain you get may not be able to deter you from learning more".

Another student used the metaphor "cannibalism" to express the excessive nature of LL. The student said:

To give you a better position in life, [LL] eats your soul out. You may look good from the outside, but your soul is tarnished. You feel like there is a wolf inside you. That wolf is [LL]. The more your soul is tarnished, the greater the wolf becomes. After a while, the wolf attacks at your psychology. It eats it, too. Once it is consumed, you reach the end of your life. When you look back on your life, you realize all that you did in life was to serve the system that enslaves humans.

The excessive nature of LL was described by another student with the metaphor of "dope". This student said, "Just like dope, [LL] makes us addicted to it; the more you have it, the more you crave for it". On the face of it, this looks like a positive thing; however, upon reflection, it is paradoxical that addiction, no matter what it is to, prevents individuals from functioning effectively. One other student used the metaphor "artist" to explain that LL is only for the *skilled* ones, losing sight that learning is unstoppable, and it is for everyone.

Discussion

This research aimed to identify undergraduate students' metaphoric perceptions of LL. Based on the convenience sampling method, and the second author's expertise area in particular, we focused on civil engineering students at a Turkish university.

The students' metaphoric perceptions of the concept pointed to both positive and negative connotations. They also indicated that the students had only limited

understanding of the concept. Although we identified a variety of attributes in their explanations for the metaphors they used (e.g., "universe," "sea," "ocean," "stars"), the most frequent ones were related to continuity and limitlessness. These are intrinsic to the meaning of the concept; yet, since they are explicit in the word "lifelong," they do not require a great deal of introspection. Consequently, we argue these do not necessarily assist in "enter[ing] the inner world of the perceptions, understanding, and experiences of the participants" (Jensen, 2006, p. 6). There were, however, other attributes pointing to the value the students gave the concept. Their use of metaphors, such as "book," "encyclopedia," and "school" and explanations for these indicate the breadth of knowledge they can gain through engagement in LL. The finding related to LL being the "meaning of life" underscores the weight of the concept in only some of the students' lives. Together, these provide valuable insights into the students' holistic understanding of the concept revealed through their metaphoric perceptions. Added to this is a few other students' reference to LL as a motivator. This was not only motivation for further learning, but also for greater involvement in life. On this account, the metaphors used by the students point to the place of LL in their lives not only for professional development but also personal fulfillment.

It is interesting to note, however, the finding that "enhancement of occupational skills" was less frequent in the data set. Considering the heavy emphasis placed upon job-related skills and knowledge as part of LL competences in engineering, this is a surprising result. A possible reason for this is the participants' current role as students. That is, at college they likely learn the most recent developments in their discipline and are not yet aware of the changes they may have to face. As a result, their only concern might be what they were being taught.

Despite some benefits expressed through the students' use of metaphors and in their explanations (e.g., expansion of horizons, enhancement of world knowledge, enhancement of occupational skills, self-fulfillment), it is also important to note the lack of reference to ways in which LL can be achieved. For instance, self-directedness is a significant concept for LL (Qinhua et al., 2016). The students' metaphoric perceptions revealed inadequate cognition of it. Neither was there any mention of qualities related to informal learning, self-directed learning, evaluation of learning, knowledge literacy or adult learning, which are among the key concepts within the realm of LL (Duman, 2007; Livingstone, 2006; the European Council, 2012). Taken together, these are suggestive that the students were not cognizant of important characteristics of LL.

Finally, and no less importantly, the results showed that some students, albeit small in number, expressed a negative sentiment about LL. To them, learning throughout life was an imposition depriving them of valuable time spent with family. Their metaphoric perceptions also included "war" and "exam," which denote hardships and competition. One could empathize with these students if they have been exposed to the narrow focus of LL on improving work-related skills and performance per se (Cruikshrank, 2002). It is important for educators to be attuned to students' feelings. Left unresolved, such feelings likely deter individuals from engaging in learning necessary for professional *and* personal development. Considering the interpersonal

nature of LL (The European Council, 2006; Deveci, 2019; Lieb-Brilhart, 1978), this has the potential to impact their family members' and friends' learning negatively, too.

Recommendations and Conclusion

The results of this study showed that the undergraduate students that participated in the study had limited perceptions of LL. Based on their limited perceptions of the concept, it was not clear if they indeed possessed the qualities of a lifelong learner. However, their metaphoric perceptions still reflected a somewhat open attitude towards LL, which can be harnessed in significant ways. First and foremost, whether or not accredited by an international board such as ABET, the civil engineering department, together with others, should seek to embed LL skills among the key learning outcomes across curricula. Different course instructors in the department should cooperate to identify key LL skills for their students as future engineers, which they teach through hands-on experience. Considering the multidisciplinary nature of engineering disciplines, these skills should be imparted to students through collaboration and cooperation among various departments in the institution. To this end, a stand-alone course on LL would not suffice (Peat et al., 2005).

It is important that students are informed about the deeper meanings of LL; their awareness ought to be raised in regard to professional as well as personal aspects of learning across their lifespans. Focusing on technical skills per se would be a disservice to them. For them to develop holistically, they should be helped to recognize the ways in which the developments in one's professional life are intertwined with those in their personal lives. Toward this end, faculty can, for example, help students notice the link between technical and artistic creations they may engage in.

The results of this study also showed that the students' responses centered upon the importance of LL without any indication of different ways in which they could engage in LL. The curricula, therefore, should highlight different forms of learning that lend themselves to engagement in LL. It would not be enough, for example, to focus on in-service training, and conference or workshop attendance. Other forms of formal education, informal learning, continuing education, etc. should be part of curricula. Additionally, extra-curricular activities should be designed to encourage students to engage in experiential learning activities geared towards their holistic development.

Faculty should also vary their assessment methods. For instance, OECD (2005) recommends that formative assessment be adopted as a means of meeting the goals of LL. It is explained that this enhances student achievement and "guide[s] students toward development of "learning to learn" skills … by placing emphasis on the process of teaching and learning, and actively involving students in that process, building students' skills for peer- and self-assessment, helping students understand their own learning, and develop appropriate strategies for "learning to learn" (OECD, 2005, p. 2). Students' learning can also be assessed with a view towards not only the product but also the processes. The latter can include different ways in which students attempt to solve given

problems, engage in team activities, and use intrapersonal communication skills, all of which are among the key skills a lifelong learner ought to develop (Deveci, 2019; Taylan & Bafail, 2019).

In the context of the current study, several caveats also need to be made. First, we collected data only from one institution. Therefore, the results of the study cannot be generalized. To understand students' metaphoric perceptions of LL, therefore, students from other contexts could be involved, too. It may also be useful to identify faculty's perceptions of LL. Students often take their teachers as role-models, so research into ways in which faculty engage in LL can provide insights into how students could be helped further. Lastly, the development of students' LL perceptions and skills can be studied longitudinally.

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Üniversite Öğrencilerinin Hayat Boyu Öğrenmeye Yönelik Olumlu ve Olumsuz Algıları: Metaforik Bir Analiz

Öz

Yükseköğretimde, teknik becerilerin yanı sıra hayat boyu öğrenme (HBÖ) becerilerine de öncelik vermelidir. Ancak bütün üniversite öğrencilerinin HBÖ'ye aşina olduğunu varsaymak doğru olur mu? Öyle olsa bile bazı öğrenciler HBÖ'nün bir tür stres kaynağı olduğuna inanıyor olabilir mi? Bunları anlamanın bir yolu, bireylerin kavramlara eklediklerine ilişkin anlamı aktarmak için yaygın olarak kullanılan metaforlardır. Dolayısıyla bu çalışmada 229 üniversite öğrencisinin HBÖ'ye ilişkin metaforik algıları incelenmiştir. Veriler söylem tamamlama formu kullanılarak toplanmıştır. Sonuçlar, seçtikleri metaforlarla yansıtıldığı gibi öğrencilerin HBÖ'ye ilişkin algılarının sınırlı olduğunu göstermiştir. HBÖ'yü tanımlamak üzere en sık kullanılan metaforlar "ağaç", "hayat", "evren" ve "yolculuk" olmuştur. Öğrencilerin belirttiği HBÖ özellikleri arasında en fazla "süreklilik", "sınırsızlık" ve "ufukların genişlemesi" yer almıştır. Ayrıca öğrencilerin kullandıkları metafor ve açıklamalarda HBÖ'ye ilişkin olumsuz algıların da bulunduğu görülmüştür. Öğrencilerin hayat boyu öğrenen bireyler olma potansiyelini artırmak için HBÖ becerilerinin üniversite müfredatının ayrılmaz bir parçası olmasını önermekteyiz.

Anahtar sözcükler: hayat boyu öğrenen, hayat boyu öğrenme, metafor, öğrenci algıları, yükseköğretim

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The Mediating Effects of Child Mastery Motivation on the Relationship Between Parenting and Children's Readiness to Learn: A Structural Equation Analysis

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Abstract

The focus of the study was to explore how parenting and children's motivation to learn would influence preschool children's readiness to learn at school. Two-hundred-thirty-two mother-father dyads reported on their socioeconomic status (SES), child rearing practices and perceptions of their preschool age children's mastery motivation (gross-motor persistence, object persistence, social symbolic persistence, and mastery pleasure). The preschool teachers reported on children's readiness measured by five domains (physical well-being, emotional maturation, social competence, language and cognitive competence and communication and general knowledge) and children's mastery motivation. Structural equation modeling (SEM) analyses revealed that mastery motivation in children was a significant and a positive predictor of children's school readiness; and the effects of parenting was mediated by mastery motivation.

Keywords: Mastery motivation, school readiness, parenting practices, mediation model, preschool children

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Introduction

Since the establishment of its republic in 1923, Turkey has been going through major and dramatic changes in its policies concerning national education with ministers serving their terms claiming that their major goal was to improve the quality of education. Within the overall framework of education, early childhood education, also referred to as preschool education in Turkey, which is not mandatory, there appears to be lack of standardized care, consistency and widespread quality, as well as access privileges currently, has been going through some major changes since 1960s (Aksoy & Eren Deniz, 2018; Özgünlü & Metindoğan, in press; Saklan, & Erginer, 2016). According to Aksoy and Eren Deniz (2018) the law, that was passed in 1973, laid out the foundation of national early childhood education policies including its target age group, purpose, and its goals to achieve for children. Specifically speaking, the aims were highlighted as ensuring "children develop physically, mentally, and emotionally; that they acquire good habits; that they are prepared for primary education; that a common environment of upbringing is provided for children who come from

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disadvantaged backgrounds; and that children speak Turkish properly" (p.114). Preschool education then was placed in kindergarten classrooms within elementary schools, independent preschools of private and public institutions.

In the year 2011, Turkish National Education went through another wave of some major changes within a few months without prior preparation of the schools or the teachers. Consequently, age for school entry was dropped down to 60 months the following school year (Kartal, 2013). Up until that time, there had been efforts to make kindergarten education mandatory for the entire nation for children to start schools ready to learn. With this change however, the plans to make kindergarten education nationwide was put on a hold as the children at the kindergarten age then was being accepted to first grade classrooms. However, there were many challenges faced by the children, parents, and the teachers.

Despite the assumption that children who start school at 60 months were ready to start school at such young ages, these children were not ready and attention and cognitive competence were major challenges faced by these children (Kapçı et al., 2013). Moreover, others found that these children, who skipped kindergarten and started first grade were not ready for school. When these children started school, they had challenges with fine motor skills, physical development, attention, focus, concentration, memory, language and communication skills, and following classroom routines just to list a few, compared to their classmates who had started school older (Kahramanoğlu et al., 2014). When these challenges were expressed by teachers and parents alike, another change was implemented and the mandatory age for school enrollment was now 66 months and parents were allowed to wait until their children were 72 months old (Kapçı et al., 2013). This action was more like reestablishing the old rule that the mandatory school entry age was 72 months. While the focus was on changing the school entry age, perhaps with a hope to get kids start school ready or to improve the quality of education, the efforts to make kindergarten education available for all were put on a hold. As of now, although Ministry of National Education (MoNE) has been announcing that there are efforts to make kindergarten education mandatory nationwide, and some pilot cities have implemented the change, mandatory early education is not in place. Meanwhile, the content of the early childhood education (ECE) curriculum was renewed, and new curriculum books were prepared in 2013 (Okul Öncesi Eğitim Programı [Preschool Education Program], 2013), in another attempt to improve quality of early childhood education. It is still unknown; however, how young children will prepare for formal schools and how older children will have better school achievement and score better on international tests such as PISA on which Turkish children have been scoring poorly (Gür et al., 2012). To sum up, although national educational policies seem to lack a more comprehensive approach to educating its youngsters and preparing them for formal schooling, a need to addresses the interconnectedness of familial, school and child related factors remain and that family systems and functioning play a key role in children's school readiness (Turnbull et al., 2022). Thus, this study focuses on exploring how within a family system, parenting styles, authoritative (democratic) and authoritarian (strict), predict children's school readiness via their effects on children's internal motivation to learn and experience new challenges.

The Relationship among Parenting Styles, Mastery Motivation and School Readiness

The issue of preparing children for school in the early childhood years is a world-wide phenomenon and has been receiving considerable attention (Welsh et al., 2010). Understandably, the concern for early development and education comes from the knowledge we have acquired in the field that early childhood experiences are very important predictors of present and future well-being, including school readiness, earning and later school achievement (see Bornstein et al., 2003; Fox & Geddes, 2016; Pianta et al., 2009; Welsh et al., 2010; Winter, & Kelley, 2008). Specifically, it has been argued that early years are critical for young children's mental development and will pave the way to future learning and development (Welsh et al., 2010). Research shows that when children complete early childhood education ready to learn, they will start primary school with a great advantage and will have significantly better chances to have successful academic life (Pan et al., 2019). This is important because academic success seems to be persistent throughout one's educational life. Researchers also conclude that children' first grade achievement scores would continue to be similar to their scores during middle and high school years suggesting that achievement is rather stable all through compulsory schooling (Rimfeld et al., 2018). All in all, the evidence suggests that early childhood period in general, and early childhood education, matters; because, although human development is a continuum, early childhood period is especially decisive for brain development, and to establish the foundations of emotional, behavioral (Osher et al., 2020), and even educational skills that will set the tone for future development and learning.

Children's readiness for school is important for children's overall well-being as well. We can argue that a comprehensive approach to children's well-being includes absence of problem behaviors, presence of positive behaviors, preventing problems from occurring, providing early intervention and opportunities to combat the limits set by the context and the genes (Buehler, 2020). Correspondingly, we can cogitate that supporting children's readiness to learn is both a preventive measure, as it helps combat school failure, and a supportive measure as it can contribute to future academic success. In fact, school failure, one of the major threats to children's well-being (Santor et al., 2020) is one of the problems children of all ages face and a major concern for educators, policy makers, and parents. When we look at factors that prevent school failure, we see, among many others, supporting children's motivation to learn and early cognitive development are important (Squires & Kefallinou, 2019).

While preparing children for school has been a focus of interest, what constitutes readiness has had various definitions. In the initial stages of school readiness research, because cognitive development was considered to be the primary factor influencing a child's school readiness, researchers focused on children's intelligence, reading, or delaying school entry. (Carlton, 1999; Carlton & Winsler, 1999; Linnenbrink & Pintrich 2002; Welsh et al., 2010). Although cognitive development is an important

element in school readiness, a focus solely on cognition is misleading insofar as it neglects such factors as parenting, and children's motivation to learn. According to Linnenbrink and Pintrich (2002), only after the 1980s researchers began to focus on motivation as a factor influencing child achievement and started integrating motivation and cognition in their research. Then in the 1990s, some researchers sought to identify motivational dynamics as possible factors influencing preschool and kindergarten age children's achievement (Eccles, 1993; Carlton, 1999; Carlton & Winsler, 1999). In more recent times, researchers are showing interest in exploring motivation as a factor influencing young children's readiness to learn (Fantuzzo et al., 2004; Henrich et al., 2005; Howse et al., 2003; MacPhee et al., 2018; Özbey & Gürler, 2019).

In broader terms, mastery motivation can be defined as young children's internal desire to explore and influence their environment without expecting a reward from others around them (Barrett-Morgan, 1995; Harter, 1992a; Harter, 1992b; Jennings & Dietz, 2003). This internal desire within mastery motivation in young children refers to their desire to learn and engage in "self-directed" behaviors without relying on rewards provided from outside forces, to have persistence to achieve challenging tasks or skills for intrinsic pleasures (Jennings & Dietz, 2003; Morgan et al., 1995; Messer, 1993). Moreover, children with higher levels of mastery motivation would prefer challenge, they would show persistence in their explorations when faced with challenging tasks that are appropriate for their development and would show interest and engage with people and materials that are provided for them to play and explore in their environment (Busch-Rossnagel &Morgan, 2013; MacPhee et al., 2018; MacTurk & Morgan, 1995; MacTurk et al., 1995; Morgan et al., 1995; Turner & Johnson, 2003). Considering that starting first grade is a challenging new experience that requires exploration and persistence, mastery motivation becomes one of the key processes for their adjustment to school and succeed (Fantuzzo et al., 2004; MacPhee et al., 2018). Furthermore, mastery motivation is not set by nature and there is great room for parents to interfere and to influence unique mastery motivation profiles their children will have, especially with their child rearing styles (MacPhee et al., 2018).

Baumrind (1967) studied the relationship between preschool children's competence and parenting attitudes and formulated parenting styles that are based on parenting practices that either hinder or support children's competence. Some of these behaviors were control, reasoning to obtain compliance, encouraging verbal give and take, use of coercive power without reason, warmth, strictness, demand for obedience, consistency, directiveness, communication. She concluded that parents who were authoritative in style (use of high control, responsiveness, reasoning, warmth and communication) had more competent children than parents who were more authoritarian (use of high control, strictness, coercive power and demand for obedience) and parents who were permissive (warmth, no demand and control). Later studies concluded that parenting styles and practices affect children's social, emotional and cognitive development (Baumrind, & Black, 1967; Bronfenbrenner, 1986; Connell & Prinz, 2002; Dornbusch et al., 1987, Fagot, 1978; Fagot & Hagan, 1991; Fung, 2022; McGillicuddy-De Lisi, 1996; Pinquart, 2016; Sigel & McGillicuddy-De Lisi, 2002). It is often found that while authoritative parenting is more advantageous, authoritarian parenting may

present some challenges for child outcomes (Pinquart, 2016; Shumow et al., 1998). Although permissive parenting seems to be associated more with behavioral problems and lack of school success across cultures (Baumrind, 1966, 1967, 1968, 1993; Durkin, 1995) the effect authoritarian parenting has on children is debated to this date (De Oliveira, 2015). While some suggest that in cultures where obedience is expected are more collectivistic, the negative effects of authoritarian parenting on children's achievement diminish (Chao, 2001), others found that culture or individualism-collectivism has no effects (De Oliveira, 2015). Studies that focus on the effects of parenting on mastery motivation show that some of the parenting behaviors that support mastery motivation are care, warmth, support, providing stimulating experiences, responsiveness, autonomy support and scaffolding (Fung, 2022; Józsa et al., 2019; MacPhee et al., 2018) which seem to coincide with authoritative parenting. Whereas, highly controlling parenting, strictness, not providing autonomy support (MacPhee et al., 2018; Moorman & Pomerants, 2008) that are associated with authoritarian parenting seem to be less optimal for the development of mastery motivation.

In conclusion, exploring how parenting influences on children's readiness to learn is mediated by children's mastery motivation would allow for an exploration of "a complex, ongoing, and dialectical process" in which children's maturation and social and cultural environment interact (Carlton, 1999, p.9). In order to better understand these processes for early childhood school readiness, current research explored a model that focused on personal motivation and parenting. Both of these factors, familial and personal, have been separately linked in past studies (Carlton, 1999; McGroder, 2000; Raver et al., 2007; Turner & Johnson, 2003; Welsh et al., 2010) to school performance and school readiness in children. Furthermore, there is some research that combined mastery motivation and parenting in predicting school readiness in more advantaged families and even fewer studies with low-income families (MacPhee et al., 2018; Moorman & Pomerantz, 2008). However, studies that connect parenting practices, mastery motivation and children's readiness to learn seems to be lacking particularly those that are in different cultural contexts. Finally, even though traditionally parenting styles research include permissive, ignoring or neglectful parenting; such parenting practices were excluded in the present study. Primary reason for this was that the goal in the study was to explore the effects of types of involvement exhibited by parents within their parenting styles, not the lack of involvement as permissive or neglectful parents seems to often exhibit in their parenting styles.

As discussed earlier, research indicates that children's academic achievement is strongly influenced by factors related to the family and the child. Thus, main objective for the present study was to test a model demonstrating pathways to children's school readiness. These pathways are family background (income and education of the parents), parenting styles (strict and democratic) and children's mastery motivation. It is expected that children's mastery motivation would mediate the relationship between parenting and children's readiness to learn in five domains. In the present study, school readiness is seen as a multifaceted phenomenon including cognitive skills, physical well-being, language and reading skills, emotional well-being and social skills, and behavioral adjustment. One of the primary assumptions guiding this perspective is that

children who are well-developed in these areas will have an advantage in school over those who have difficulty in one or more of these areas. Thus, testing the model will first consist of testing a series of structural equation models examining pathways to each of the five domains of school readiness: Physical readiness, emotional maturation, social competence, language and cognitive competence and communication, and general knowledge. In these models, the pathways that originate in a family setting are considered to be parenting dimensions that are called strict and democratic parenting. Then the mediating variable, mastery motivation will be introduced into the model. This model assumed that structural variables such as parental income and education would influence parenting practices and the parenting practices in turn would influence child mastery motivation and this would finally inform school readiness in five different domains.

It is expected that higher levels of authoritative parenting would be associated with higher levels of mastery motivation and school readiness among Turkish children. On the other hand, authoritarian parenting is expected to be negatively associated with mastery motivation and school readiness. Finally, it is expected that children's mastery motivation would mediate the relationship between parenting styles and children's school readiness in all five domains.

Method

Participants

As data were collected as part of a doctoral dissertation in a major metropolitan province in Turkey (Metindogan-Wise, 2007) ethics approval was received from Syracuse University Institutional Review Board (01.01.2004-IRB041) and the Ministry Education of Turkey. After the approval received from the ministry, preschools as well as elementary schools with preschool classrooms in Ankara metropolitan areas were contacted to ask whether they would be willing to participate in the present study. Once the schools agreed, preschool teachers were asked to contact the parents to invite them to participate in the study and to deliver the questionnaire packets. Parents returned the completed and sealed envelopes to the teachers. There were 234 mother-father dyads of preschool age children reporting about their parenting practices, children's mastery motivation and demographic information. The mothers ranged in age from 20.7 to 49 years with an average age of 32.8 years (*SD* = 4.98). Education level was asked using a Likert Scale, 1 referring to uneducated to 6 referring to post graduate degrees. The modal mother had a high school degree and of the remaining mothers, 31% had less than high school education, 39% had high school, and 27% had higher education; 61% of the mothers were homemakers while only 34% reported holding a job. The rest (5%) were either currently unemployed, retired or did not report their work status.

The fathers' ages ranged from 25.5 to 55.0 years with an average age of 36.6 (*SD* = 5.34). The average father had a high school degree and had completed some college work (*SD* = 1.44). Fathers' education levels ranged from less than high school

(31%), high school (33%) to higher education (34%) with 4% holding graduate degrees. The majority of the fathers were employed (88%) while the rest were currently unemployed or retired (2%). The average family income was in the range of 951-1,110 Turkish Lira, monthly, equaling $717.36 – $829.75 at the time of data collection.

The average age of the target preschool child was 5.6 years (*SD* = .39) with the ages ranging from 4.4 years to 6.5 years; only 1.7% of the children were reported to have minor physical handicaps. One-hundred fourteen of the children were girls (49%) and one-hundred twenty of them were boys (52%). Demographic information may be found in Table 1.

Table 1

Sociodemographic Characteristics of Parents

		N	Min	Max	Mean	*SD*
Mothers' Education		232	1.00	8.00	2.93	1.46
Fathers' Education		227	1.00	6.00	3.15	1.45
Mothers' Age		204	20.74	49.02	32.73	5.27
Fathers' Age		205	25.54	55.03	36.51	5.62
Income		236	1.00	14.00	7.37	3.79
Child Age	Boys	121	4.36	6.46	5.59	.42
	Girls	113	4.44	6.38	5.60	.35

Measurements

Socio-economic Status and Living Arrangements

Parents provided information about their socio-economic status, (income and their educational background) living and child-care arrangements, including whether they lived with extended family, who the primary caregiver of the child was and whether child attended day-care. These were asked by close-ended questions that listed possible alternatives and that participants could also respond in writing if the listed choice selections were not inclusive of their responses.

Child Rearing Practices

Child rearing practices were measured using a revised version of Child Rearing Practices Q-Sort-Revised (CRPQ-R, Block, 1965; Roberts, 1999). The original questionnaire had 99 items and measures the dimensions of parenting such as cool/distant, conflict, encourages autonomy, protective/indulgent, discourages emotional expression. Examination of the reliability estimates (Cronbach alphas; Cronbach, 1954) indicated that the overall scale was reliable, with alphas = .834 for mothers, and .874 for fathers. After conducting principal-components factor analysis with a two-factor solution (Dekovic et al., 1991), final authoritative parenting consisted of 17 items and

the authoritarian parenting consisted of 10 items both for mothers and fathers. The reliability analyses using Cronbach alphas for the final factors revealed good to moderate internal consistency with the alphas ranging for authoritative mothering = .80, authoritative fathering = .88, authoritarian mothering = .61, and authoritarian fathering = .60.

Child Mastery Motivation

In order to measure children's mastery motivation, parents and teachers were asked to report on Dimensions of Mastery Questionnaire (DMQ; MacTurk et al., 1995). The DMQ consists of four different subscales yielding four composite scores including persistence, total mastery pleasure, general competence, and negative reaction to failure. Examination of the reliability estimates using Cronbach alphas indicated that the overall scale was very reliable with an alpha of .90 for teachers, of .85 for mothers, and, of .87 for fathers.

School Readiness

The "Early Development Instrument: A Population-based Measure for Communities" (EDI) is used to assess children's development (Janus & Offord, 2003a). This 120-item scale assesses both "the outcome of early years" and "children's readiness to learn at school" (Janus & Offord, 2003b). This teacher completed scale consists of 120 items and five sub-scales measuring physical health and well-being, social competence, emotional maturity, language and cognitive development, communication skills and general knowledge. Cronbach's Alpha reliability analyses were good and revealed Cronbach's alphas of .80 for physical health and well-being, .98 for social competence, .92 for emotional maturity, .96 for language and cognitive development, and .94 for communication skills and general knowledge.

Questionnaires that were assessing child mastery motivation, children's school readiness to learn and parenting styles were originally in English. In order to adapt these questionnaires into Turkish, translation and back translation approach was implemented. After this process was complete, two doctoral students who were native in Turkish and fluent in English checked the translations and agreed on the final forms. Finally, two Turkish primary school teachers read and commented on the Turkish translations for clarity and cultural appropriateness for the final forms to be revised. Because of time limitations, an independent pilot study could not be implemented. However, as the data were collected, data were checked for reliability to make sure the final data could be reliable.

Results

Child Care and Living Arrangements

Families that included both the mothers and fathers were included in the study and they were asked about their caregiving responsibilities for their preschool aged child. Of those mothers, 82% indicated that they were the primary caregivers of their children and only 11% reported both mothers and fathers were equally responsible for childcare of their children. Approximately 7% of the mothers reported that some other family member was a primary caregiver. In contrast, 34% of the fathers did not report anyone as a primary caregiver. Out of the remaining 66% of fathers, over half (58%) reported that mothers were the primary caregivers and 6% reported that both mothers and fathers were primary caregivers of their children.

Parenting Styles

In order to examine whether Turkish parents employed more authoritative or authoritarian parenting styles while interacting with their preschool-age children, two-way repeated measures ANOVA (parent sex X parenting style) analyses were conducted. Results indicated that sex of the parent, did not have an effect on the type of parenting style Turkish parents employed, $F(1, 233) = 2.27$, $p > .05$. This suggested that mothers and fathers were similar in their parenting styles. Results however, revealed that there was a significant parenting style main effect, indicating that mothers and fathers both differed in their parenting styles, $F(1, 233) = 1203.77$, $p < .001$. Examination of the parenting style main effect revealed that both mothers and fathers were more authoritative than they were authoritative (See Table 2).

Table 2

Mean Scores of Maternal and Paternal Parenting Styles

	Mean	*N*	*SD*	*SE*
Authoritative Mothering	5.37	234	.41	.03
Authoritarian Mothering	3.54	234	.71	.05
Authoritative Fathering	5.25	234	.59	.04
Authoritarian Fathering	3.50	234	.70	.05

Structural Equation Modeling

Structural equation modeling (SEM) that allows to “create single latent constructs with multiple indicators” (Sabatelli & Bartle, 1995, p.1034) was used in the analyses. Maximum likelihood estimates that were obtained using Amos 4.0 software (Arbuckle, 1999) were used. Consistent with Arbuckle and Wothke’s (1999) advice, a critical ratio

(C.R.) of 1.96 ($p < .05$) and higher was considered to be significant. Because the analysis of gender differences did not reveal multivariate effects of child gender, the models were computed for the whole sample. According to several authors (e.g., Byrne, 2000; Civelek, 2018; Marcoulides & Schumacker, 2001), for perfect model fit, GFI, AGFI, and CFI values should be 1, however, values above .9 are considered to indicate good model fit. Similarly, while an RMSEA value of 0 indicated that the data fit the model very well, a value of less than .05 is thought to indicate an adequate model fit although values as high as .08 are reported to indicate adequate model fit (Byrne, 2000). Additionally, Chi-squares ($\chi 2$) and their associated degrees of freedom (*df*) were also used to determine the model fit; a non-significant $\chi 2$ is needed to be able to conclude that the hypothesized model and the perfect fit are not different. These goodness of fit estimates are used commonly in the literature to test for model fit (Byrne, 2000; Civelek, 2018; Marcoulides & Schumacker, 2001).

Variables in SEM Analyses

Teacher ratings were used to create the variables for each of the five domains of school readiness (physical health and well-being, social competence, emotional maturation, language and cognitive competence, and communication and general knowledge).

The mastery motivation variables for each domain were used as latent variables. These latent variables were informed by domain specific persistence scores and mastery pleasure scores. Thus, physical mastery motivation was informed by gross motor persistence and mastery pleasure; social mastery motivation as a latent variable was informed by social-symbolic persistence and mastery pleasure; and finally, mastery motivation for cognition and, language and communication and general knowledge was informed by object persistence, social symbolic persistence and mastery pleasure. Mastery pleasure scores consisted of composite scores of reports from mothers, fathers, and teachers. Persistence scores for each mastery motivation domain were also composite scores of reports from mothers, fathers, and teachers. Unlike results for school readiness, for mastery motivation variables, teachers and parents were both considered to provide unique sources of information regarding mastery motivation of children due to their observations of children in different settings (Turner & Johnson, 2003). For that reason, based on what Turner and Johnson (2003) suggested, three composite scores that measured different aspects of children's mastery motivation: physical mastery motivation, social mastery motivation, and mastery motivation for cognition and general knowledge were computed.

Model Testing

In order to analyze the hypothesized models, the links among the constructs in the models were explored and confirmed using Pearson-r correlations (Conger et al., 2002; Scaramella et al., 1998). To test the model, first the full model of school readiness for each of the five domains was tested, and then specific mastery motivation variables as mediating variables between parenting (SES and parenting styles) and school readiness in each domain were tested. Next, the non-significant paths were dropped, and the

revised model were recomputed (Civelek, 2018; Pedhazur, 1997; Turner & Johnson, 2003). The final step of mediation testing included computing the models without the specific mastery motivation variable for each domain to estimate the model fit with and without the mediating variable in the model. According to Baron and Kenny (1986), for a true mediation effect to be present, the direct relationship between the exogenous variables (parenting styles, income, and education) and the outcome variables (school readiness variables) need to drop down or be non-significant after the introduction of mediating variables. Consistent with what Baron and Kenny (1986) and Kenny (2006) recommend, Sobel test (Sobel, 1982) was used as an additional testing to assess whether the mediation effect observed in the data were significant.

Model for Physical Readiness for School

Mothers

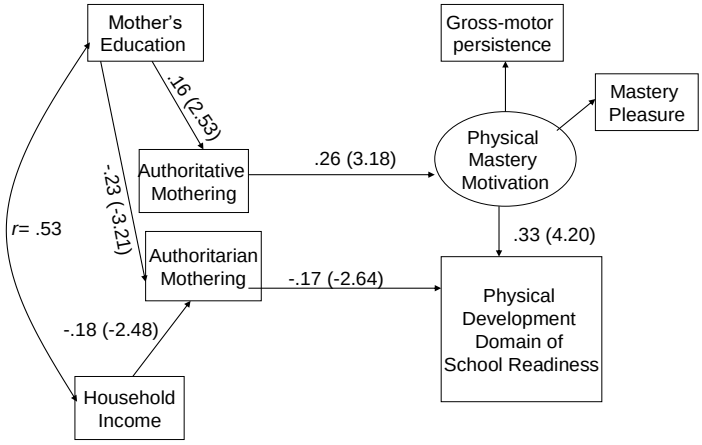
Having established the links between maternal education, income and parenting styles for mothers, the latent variable of physical mastery motivation was introduced into the model. In the model, authoritative mothering was a significant predictor of mastery motivation, $\beta = .20$, C.R. = 1.95, indicating higher levels of authoritative mothering were associated with higher levels of mastery motivation. No other variable was associated with mastery motivation. The model, however, explained only 6% of the variance. Examination of goodness of fit statistics indicated that the model fit the data well, $\chi 2 = 5.52$, $df = 5$, $p = .36$ (*ns*); RMSEA = .02, GFI = .99; AGFI = .96; CFI = 1.00.

After fixing the non-significant pathways to 0 (zero) and introducing the outcome variable, physical readiness for school, the results indicated that authoritative mothering, $\beta = .26$, C.R. = 3.18, continued to be significantly and positively associated with physical mastery motivation. The strength of the association, however, increased. No other variable was associated with physical mastery motivation. Physical mastery motivation was significantly and positively associated with physical health and well-being, $\beta = .33$, C.R. = 4.20. There was a direct and a negative association between authoritarian mothering and physical health and well-being, $\beta = -.17$, C.R. = -2.64. This model explained 16% of the variance in physical health and well-being. Examination of goodness of fit statistics indicated that the model fit the data well, $\chi 2 = 8.16$, $df = 9$, $p = .52$ (*ns*); RMSEA = .00, GFI = . 99; AGFI = .97; CFI = 1.00.

After dropping mastery motivation (mediating variable) from the model, results indicated that the strength of the relationship between authoritarian mothering and physical readiness had increased slightly, $\beta = -.19$, C.R. = -2.72. Authoritative mothering was not related to physical readiness for school suggesting an indirect effect of authoritative mothering through physical mastery motivation. The model without physical mastery motivation only explained 6% of the variance in physical readiness for school. The model still fit the data well, $\chi 2 = .68$, $df = 2$, $p = .71$ (*ns*); RMSEA = .00, GFI = .1.00; AGFI = .99; CFI = 1.00. Sobel's test showed that there was an indirect effect of authoritative mothering on physical health and well-being of children mediated by physical mastery motivation, $Z = 2.39$, $p < .05$ (See Figure 1).

Figure 1

Mothers' Trimmed Child Mastery Motivation Model for Physical Readiness (Standardized Regression Coefficients with Critical Ratios)



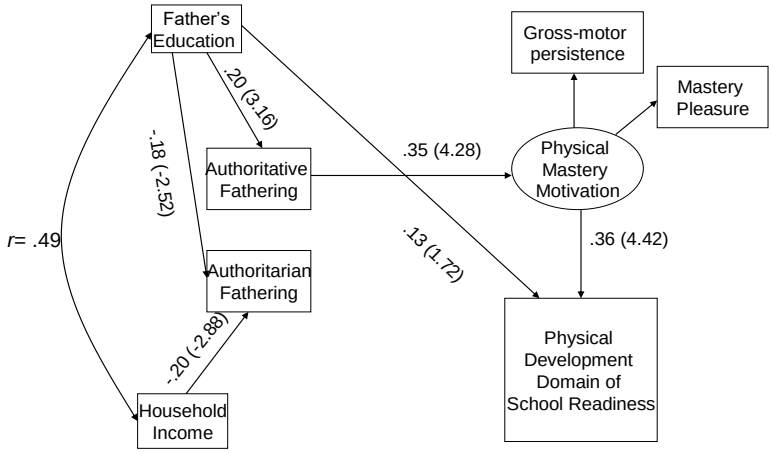
Fathers

In the model examining the effects of fathering (authoritative and authoritarian), parental income and fathers' education on physical mastery motivation, authoritative fathering was significantly associated with physical mastery motivation, β = .36, C.R. = 4.14. No other variables were associated with physical mastery motivation and the model explained 13% of the total variance in physical mastery motivation. The model fit the data well, $\chi 2 = 3.91$, $df = 5$, $p = .56$ (*ns*); RMSEA = .00, GFI = .99; AGFI = .98; CFI = 1.00.

After fixing the non-significant paths to zero, and including physical health and well-being in the model, physical mastery motivation was significantly and positively associated with physical health and well-being, β = .36, C.R. = 4.42. A slight increase in the association between authoritative fathering and physical master y motivation was also observed. The model explained 15% of the variance. The model fit the data well, $\chi 2 = 4.81$, $df = 9$, $p = .85$ (*ns*); RMSEA = .00, GFI = .99; AGFI = .98; CFI = 1.00. Finally, after dropping the mediating variable and testing the model, none of the variables was associated with physical health and well-being and the model explained only 3% of the variance. The model fit the data well, $\chi 2 = .27$, $df = 2$, $p = .88$ (*ns*); RMSEA = .00, GFI = 1.00; AGFI = 1.00; CFI = 1.00. The result of the Sobel's test revealed that there was in fact an indirect effect, $Z = 3.08$, $p < .01$ (See Figure 2).

Figure 2

Fathers*' Trimmed Child Mastery Motivation Model for Physical Readiness (Standardized Regression Coefficients with Critical Ratios)*



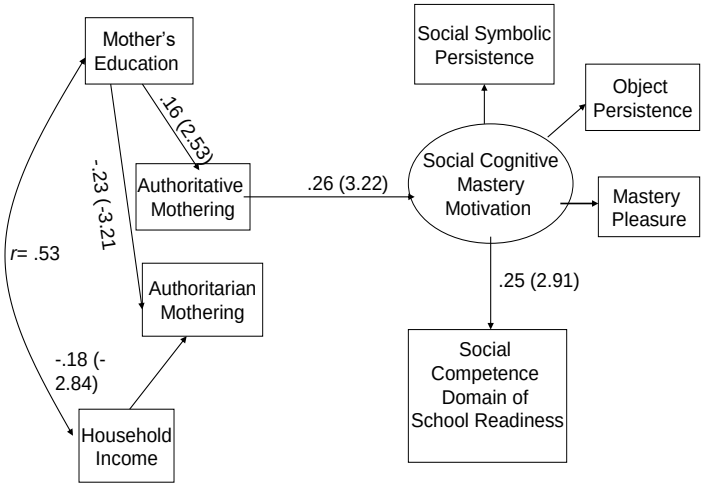
Model for Social Competence

Mothers

Results indicated that authoritative mothering was positively and significantly associated with social mastery motivation, β = .25, C.R. = 2.52, with model explaining 7% of the variance. The model fit the data well, $\chi 2 = 6.91$, $df = 5$, $p = .23$ (*ns*); RMSEA = .04, GFI = .99; AGFI = .96; CFI = .99. After fixing non-significant paths to zero and introducing the outcome variable, results indicated that social mastery motivation was positively associated with social competence, β = .25, C.R. = 2.91. Out of the remaining predicting variables, none was associated with social competence. The strength of the relationship between authoritative mothering and social mastery motivation increased, β = .26, C.R. = 3.22. The model fit the data well, $\chi 2 = 10.74$, $df = 9$, $p = .30$ (*ns*); RMSEA = .03, GFI = .99; AGFI = .96; CFI = .99. Dropping social mastery motivation from the model revealed no significant relationship between the exogenous variables and the endogenous variable. Although dropping social mastery motivation did not result in a significant direct effect of authoritative mothering on social competence, Sobel's test revealed that there was in fact an indirect effect of authoritative mothering on social competence among Turkish children, $Z = 2.16$, $p < .05$ (See Figure 3).

Figure 3

Mothers' Trimmed Child Mastery Motivation Model for Social Competence (Standardized Regression Coefficients with Critical Ratios)



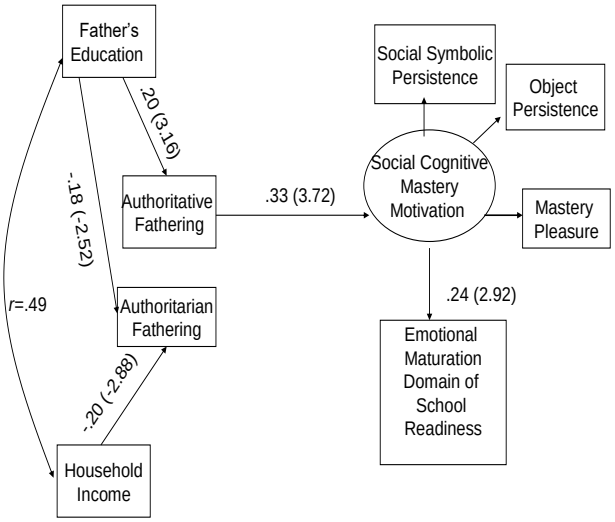
Fathers

Results indicated that fathers' authoritative fathering was significantly and positively related to social mastery motivation, β = .30, C.R. = 2.72. No other variable was related to social mastery motivation and the model explained 9% of the variance. Examination of model fit indices indicated that model fit the data well, $\chi 2$ = .24, *df* = 4, *p* = .66 (*ns*); RMSEA = .00, GFI = 1.00; AGFI = .98; CFI = 1.00. After fixing the non-significant paths to 0 (zero) and introducing the outcome variable into the model, results indicated that authoritarian fathering was significantly and positively related to social competence among Turkish preschool children, β = .15, C.R. = 2.26. Authoritative fathering was still significantly related to social mastery motivation, β = .31, C.R. = 3.45. A significant relationship between the mediating variable and the outcome variable was observed, β = .19, C.R. = 2.40. The whole model accounted for 6% of the variance and fit the data well, $\chi 2$ = 7.71, *df* = 9, *p* = .56 (*ns*); RMSEA = .00, GFI = .99; AGFI = .97; CFI = 1.00. Authoritarian fathering was still significantly and positively associated with social competence even after social mastery motivation was dropped from the model, β = .15, C.R. = 2.18. The model now accounted for only 3% of the variance although the model continued to fit the data well, $\chi 2$ = .12, *df* = 1, *p* = .73 (*ns*); RMSEA = .00, GFI = .1.00; AGFI = 1.00; CFI = 1.00. Sobel's test revealed that there was an indirect effect of authoritative fathering on social competence mediated by social mastery motivation,

$Z = 2.01$, $p < .05$. The effect of authoritarian fathering however was only a direct effect on social competence (See Figure 4).

Figure 4

Fathers' Trimmed Child Mastery Motivation Model for Social Competence (Standardized Regression Coefficients with Critical Ratios)



Model for Emotional Maturation Domain of School Readiness

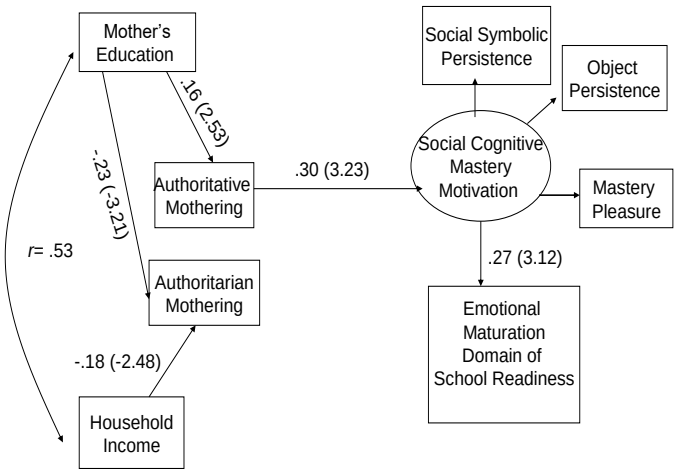
Mothers

Because the link between social-symbolic persistence and mothering variables was already established, non-significant pathways between authoritarian mothering and social-symbolic persistence, maternal education and social symbolic persistence, and income and social symbolic persistence were set to 0 (zero). Results indicated that social mastery motivation was positively and significantly related to the emotional maturation domain of school readiness, $\beta = .27$, C.R. = 3.12. The significant and positive link between authoritative mothering and social mastery motivation was still observed, $\beta = .26$, C.R. = 3.23. The model explained only 7% of the variance and the model fit the data well, $\chi 2 = 10.61$, $df = 9$, $p = .30$ (*ns*); RMSEA = .03, GFI = .99; AGFI = 96; CFI = .99. Dropping social mastery motivation from the model did not result in any significant relationships between the predictor variables and the outcome variable although the model fit the data well, $\chi 2 = 68$, $df = 2$, $p = .71$ (*ns*); RMSEA = .00, GFI = 1.00; AGFI = .99; CFI = 1.00. Sobel's test revealed that the indirect effect of

authoritative mothering on emotional maturation/competence through social mastery motivation was indeed significant, $Z = 2.24$, $p < .05$ (See Figure 5).

Figure 5

Mothers' Trimmed Child Mastery Motivation Model for Emotional Maturation (Standardized Regression Coefficients with Critical Ratios)

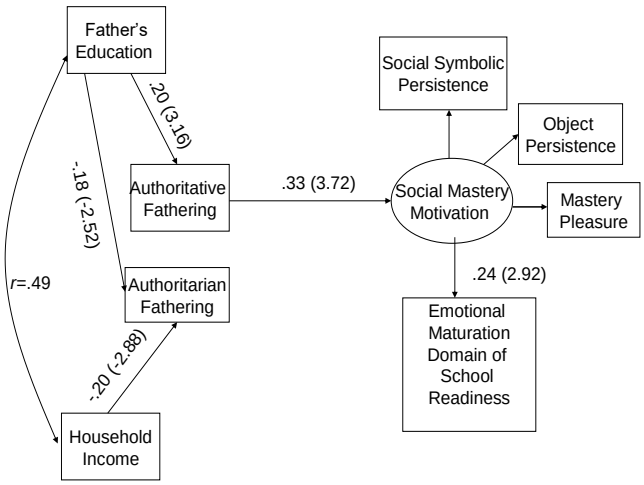


Fathers

Because the link between social-symbolic persistence and fathering variables was already established; the full model with fathering, social mastery motivation and emotional maturation was examined. Results revealed that authoritative fathering continued to be significantly associated with social mastery motivation, $\beta = .33$, C.R. = 3.72, and social mastery motivation was positively associated with emotional maturation & competence, $\beta = .24$, C.R. = 2.92. The model explained only 7% of the variance although the model fit the data well. $\chi 2 = 6.19$, $df = 5$, $p = .29$ (*ns*); RMSEA = .00, GFI = .99; AGFI = .97; CFI = 1.00. Dropping social mastery motivation from the model did not result in any significant relationships between the predictive variables and the outcome variable. Sobel's test examining the significance of mediating effect of social mastery motivation on emotional maturation & competence revealed that the indirect effect was in fact significant, $Z = 2.92$, $p < .05$ (See Figure 6).

Figure 6

Fathers' Trimmed Child Mastery Motivation Model for Emotional Maturation (Standardized Regression Coefficients with Critical Ratios)



Model for Language and Cognitive Domain of School Readiness

Mothers

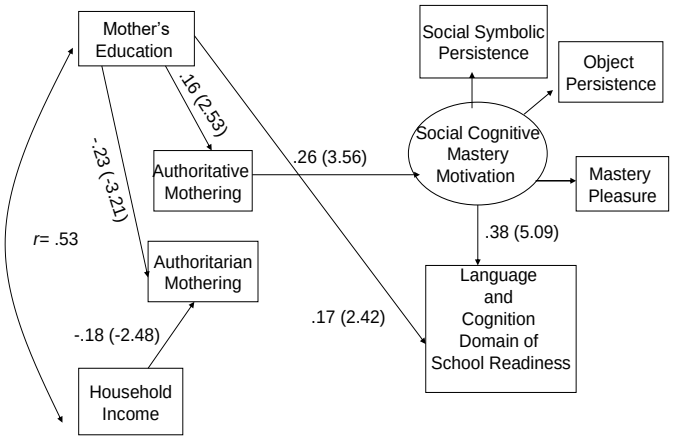
Results revealed a significant and positive relationship between authoritative mothering and mastery motivation, β = .26, C.R. = 3.55, and the model explained 8% of the variance in mastery motivation for cognition and general knowledge. Examination of the model fit indices indicated a good model fit, $\chi 2 = 8.97$, $df = 9$, $p = .44$ (*ns*); RMSEA = .00, GFI = .99; AGFI = .97; CFI = 1.00. After fixing the non-significant paths to 0 (zero), authoritative mothering was now significantly and positively associated with children's mastery motivation for cognition and general knowledge, β = .26, C.R. = 3.56. Maternal education was significantly and positively related to language and cognitive competence β = .17, C.R. = 2.42. The association between children's mastery motivation for cognition and general knowledge and language and cognitive competence was positive and significant, β = .38, C.R. = 5.09. The model accounted for 23% of the variance. Examination of the model fit indices indicated a good model fit, $\chi 2 = 10.98$, $df = 14$, $p = .69$ (*ns*); RMSEA = .00, GFI = .989; AGFI = .97; CFI = 1.00.

After dropping mastery motivation to examine mediation a positive association that approached conventional levels of significance between authoritative mothering and language and cognitive competence was obtained, β = .12, C.R. = 1.95. Similarly, authoritarian mothering also approached statistical significance, β = -.13, C.R. = -1.95. This association, however, was negative. Finally maternal education continued to be

positively associated with language and cognitive competence, β = .18, C.R. = 2.31. Testing the significance of the indirect effect of authoritative mothering using the Sobel's test revealed that the mediation was in fact significant, $Z = 2.90$, $p < .01$. Examination of the model fit indices indicated a good model fit, $\chi 2 = .68$, $df = 2$, $p = .71$ (*ns*); RMSEA = .00, GFI = 1.00; AGFI = .99; CFI = 1.00 (See Figure 7).

Figure 7

Mothers' Trimmed Child Mastery Motivation Model for Language and Cognition (Standardized Regression Coefficients with Critical Ratios)



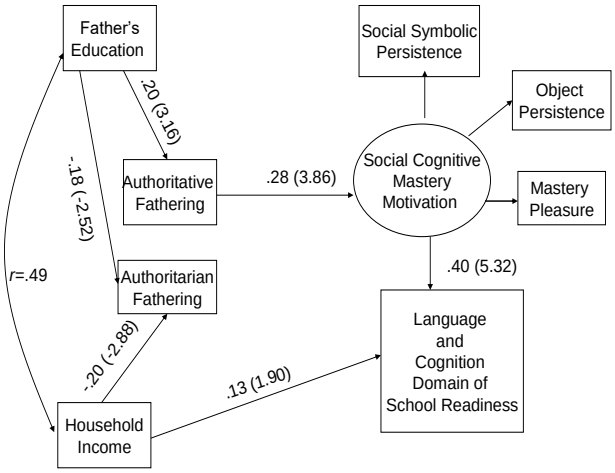
Fathers

Results revealed a significant and positive relationship between authoritative fathering and mastery motivation for cognition and general knowledge, β = .29, C.R. = 3.90. Examination of the model fit indices indicated a good model fit, $\chi 2 = 16.25$, $df = 10$, $p = .09$ (*ns*); RMSEA = .05, GFI = .98; AGFI = .95; CFI = .98. After dropping the non-significant pathways and including the language and cognitive competence in the model, the results revealed that paternal income was now closer to being significantly and positively related to language and cognitive competence, β = .13, C.R. = 1.90. Authoritative fathering continued to be related to mastery motivation for cognition and general knowledge, β = .28, C.R. = 3.86. Mastery motivation for cognition and general knowledge was also significantly and positively associated with language and social competence, β = .40, C.R. = 5.32. The model explained 21% of the variance in language and cognitive competence. Examination of the model fit indices indicated a good model fit, $\chi 2 = 17.66$, $df = 15$, $p = .28$ (*ns*); RMSEA = .03, GFI = .98; AGFI = .96; CFI = .99. Dropping the mediating variable, did not result in any significant association between the predictive variables and the outcome variable. Examination of Sobel statistics revealed that the indirect effect of authoritative fathering on language and cognitive

competence through mastery motivation was significant, $Z = 2.98$, $p < .01$ (See Figure 8).

Figure 8

Fathers' Trimmed Child Mastery Motivation Model for Language and Cognition (Standardized Regression Coefficients with Critical Ratios)



Model for Communication and General Knowledge

Mothers

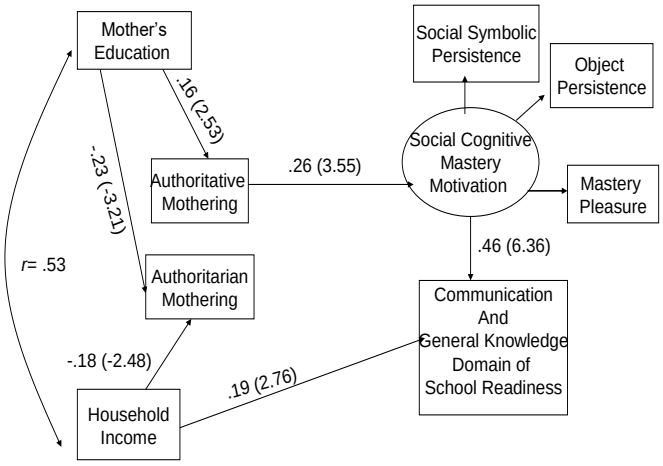
The results revealed a significant and positive relationship between authoritative mothering and mastery motivation, β = . 26, C.R. = 3.55. The model explained 8% of the variance in mastery motivation and fit the data well, $\chi 2 = 8.97$, $df = 9$, $p = .44$ (*ns*); RMSEA = .00, GFI = . 99; AGFI = .97; CFI = 1.00. After fixing the non-significant paths to 0 (zero) and introducing the outcome variable into the model, results revealed that income was significantly associated with child communication and general knowledge, β = 19, C.R. = 2.76. Mastery motivation was significantly and positively associated with communication and general knowledge, β = .46, C.R. = 6.35. Authoritative mothering was also significantly associated with communication and general knowledge. The model explained 31% of the variance in communication and general knowledge and fit the data well, $\chi 2 = 12.94$, $df = 15$, $p = .61$ (*ns*); RMSEA = .00, GFI = .99; AGFI = .97; CFI = 1.00.

Dropping the mediating variable, mastery motivation, resulted in a significant effect of authoritative mothering on communication and general knowledge, β = .13, C.R. = 2.07, suggesting a significant mediating effect of mastery motivation between authoritative mothering and communication and general knowledge. Testing the

significance of this mediating effect using Sobel statistics revealed that this indeed was a significant indirect effect, $Z = 3.09$, $p < .01$. Income was also significantly and positively associated with communication and general knowledge, β = .15, C.R. = 2.07, but the effect had less strength with the removal of mastery motivation from the model. This model without mastery motivation explained 10% of the variance in communication and general knowledge. The model fit the data well, $\chi 2 = .68$, $df = 2$, $p = .71$ (*ns*); RMSEA = .00, GFI = 1.00; AGFI = .99; CFI = 1.00 (See Figure 9).

Figure 9

Mothers' Trimmed Child Mastery Motivation Model for Communication and General Knowledge (Standardized Regression Coefficients with Critical Ratios



Fathers

My first step in analyzing the model of communication and general knowledge domain of school readiness of Turkish children was to examine the direct effects of parenting variables on mastery motivation. Results revealed that authoritative fathering was significantly and positively related to mastery motivation, β = .29, C.R. = 3.87. The model explained 8% of the variance in mastery motivation. The model fit the data well, $\chi 2 = 16.10$, $df = 9$, $p = .07$ (*ns*); RMSEA = .06, GFI = .98; AGFI = .94; CFI = 98.

After fixing non-significant paths to zero and adding the communication and general knowledge into the model, authoritative fathering and mastery motivation were still significantly related, β = .28, C.R. = 3.81. Mastery motivation for cognition and general knowledge was significantly and positively associated with communication and general knowledge, β = .47, C.R. = 6.20. Income was another variable that was significantly and positively associated with communication and general knowledge, β = .21, C.R. = 3.21. The model explained 31% of the variance in communication and

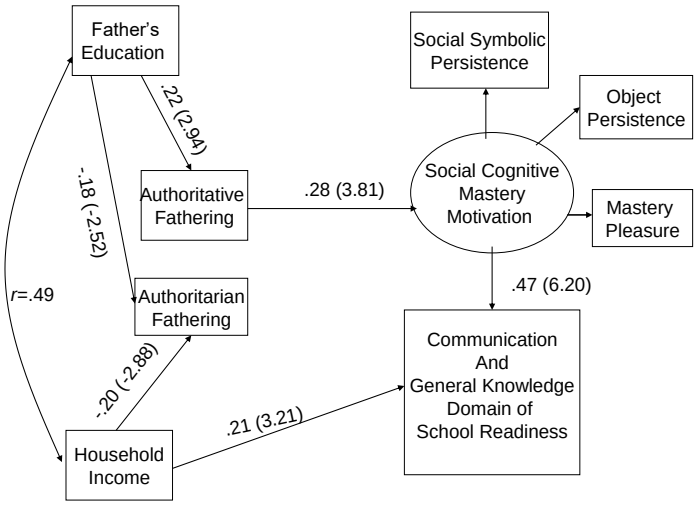
general knowledge and model fit the data well, $\chi 2 = 18.61$, $df = 14$, $p = .18$ (*ns*); RMSEA = .04, GFI = .98; AGFI = .95; CFI = .99.

When mastery motivation was dropped from the model, income continued to be significantly associated with communication and general knowledge, $\beta = .203$, C.R. = 2.80. Importantly, authoritative fathering was now significantly associated with communication and general knowledge, $\beta = .15$, C.R. = 2.41, suggesting a complete mediation effect of mastery motivation for cognition and general knowledge between authoritative fathering and communication and general knowledge. The Sobel test conducted to test the significance of this mediation effect revealed the mediation effect was indeed a significant one, $Z = 2.24$, $p < .01$. The model explained only 9% of the variance in communication and general knowledge without the mastery motivation for cognition and general knowledge and the model and fit the data well, $\chi 2 = .27$, $df = 2$, $p = .88$ (*ns*); RMSEA = .00, GFI = 1.00; AGFI = 1.00; CFI = 1.00.

In summary, in the domain of communication and general knowledge some similar effects for Turkish mothers and fathers were observed. For both mothers and fathers, again authoritative parenting had a significant effect on child communication and general knowledge. For communication and general knowledge, the mediating effects of mastery motivation for cognition and general knowledge seemed to be stronger and the effect was complete. A difference between mothers and fathers was that the income of mothers, but not fathers had a direct and a significant effect on communication and general knowledge of Turkish children (See Figure 10).

Figure 10

Fathers' Trimmed Child Mastery Motivation Model for Communication and General Knowledge (Standardized Regression Coefficients with Critical Ratios)



Discussion, Conclusions, and Implications

Results of this study suggested that authoritative practices of the parents resulted in children to be more motivated and more competent in all five domains of school readiness. Authoritarian mothering, although negatively associated with outcome variables, was not a significant predictor explaining children's school readiness directly or indirectly thorough mastery motivation. This is interesting because even though Turkish culture holds traditional elements, this finding was comparable to the findings from western cultures proposed by Baumrind (1966; 1967). And the findings that the relationship between authoritarian parenting and school readiness is negative seems to be different from Chao's (1994; 2001) findings with parents of Chinese descent. Authoritative parenting includes control similar to authoritarian parenting. However, authoritative parenting, unlike authoritarian parenting includes practices such as warmth and reasoning that could allow for control acts to be perceived as more concerned and caring. This could allow for such practices to be associated with competence. This result supports the "Family Change Model" proposed by Kagitcibasi (1996; 2006; 2007) that Turkish culture is more representative of a culture where there is a dialectic synthesis of East and West.

Findings revealed that both mothers' and fathers' authoritative parenting, but not authoritarian mothering or fathering, were significant and positive predictors of mastery motivation among Turkish preschool children. This is similar to the findings of existing research that when parenting and home environment are supportive, caring and demanding, children are better supported and motivated (MacPhee et al., 2018). Moreover, the findings also showed that both mothers' and fathers' education and income to an extent, were positive predictors of authoritative parenting and negative predictors of authoritarian parenting. It seems that parents who are better educated are more optimal in their parenting behaviors that lead children to be motivated to master. These findings support existing research that provides robust evidence that income and particularly parental education are significant predictors of numerous child developmental outcomes (Kotaman, 2018; Querido et al., 2002). It is possible that these parents stimulate their children better and provide developmentally appropriate challenges and encourage their children to explore creating a stimulating environment (MacPhee et al., 2018). It is reasonable to assume that parental income and education mean easier access to resources to provide for children. Thus, it would be important for educational policy makers to focus more on improving the skills of economically disadvantaged parents. Because parents of preschool age children go to schools and have contact with teachers more than parents of any other age group, it would be important for teachers to take advantage of these visitations to help improve the parenting skills of these parents (See Honig, 1975) such as helping parents to develop skills to reason and play with their children, stimulate them and allow them to explore their environment through scaffolding (Vygotsky, 1979).

Another important finding of the present study was that mastery motivation was a significant predictor of all five of the domains of school readiness. This finding

was consistent with other research examining the relationship between mastery motivation and academic success among preschool and older age groups (Cheung & McBride-Chang, 2008; Gottfried, 1985; Józsa et al., 2019; Linnenbrink & Pintrich, 2002; MacPhee et al., 2018; Özber & Gürler, 2019; Turner & Johnson, 2003). Present finding that mastery motivation was the most significant predictor of all five domains of school readiness supports the proposition that motivation is an essential resource for children to reach their potential (Paris et al., 2006). Based on this, we can conclude that one great pathway that goes to children's achievement starting in the home environment goes through mastery motivation.

The results of this research are interesting because even though the findings are in agreement with western literature on parenting that authoritative parenting is associated with positive child outcomes, the parental effects on child outcomes, in this case, school readiness, seem to go through the effects parents have on children's motivation to learn. Moreover, the effects of parental income and education seem to follow a path that goes through parents to mastery motivation and finally to children's readiness. As MacPhee et al. (2018) suggested, mastery motivation is "malleable" and that parents can help children to be better motivated to approach new challenges and have inner desires to learn. Specifically, findings of this research suggests that parental authoritative approaches such as reasoning with the child, expressing affection, playing with the child, encouraging the child to be more expressive and allowing child to take responsibilities are valuable for children to be motivated to master new and relatively challenging tasks. These types of interactions promote the child's internal motivation to be persistent in their interactions with social and physical world and get pleasure with mastering skills and as a result be competent in various areas of development and tackle the challenges of further schooling.

One important implication of the present study is that if teachers and parents want children to be successful, they need to make sure these children want to and love learning. One way both parents and teachers can accomplish this is by creating more democratic and supportive environments in which children are seen as active agents in their own lives. Allowing children to develop autonomy, providing children with more age-appropriate challenges and responsibilities as well as encouraging them to be more active learners are crucial. This way, it would become possible for children to experiment with their skills and learn new ones. Also, focusing on children's efforts rather than the products when they are working on a project could encourage children to be more persistent, hence allowing them to master the skill they are working on. It is important to note that Parent's educational involvement does not necessarily mean they need to teach their young children how to read or write or teaching them their numbers. Rather, at early ages, parents can be involved in their children's learning by understanding children's signs of frustration and joy during challenging tasks as well as how children react to failures and successes. These signs, correctly interpreted, can give valuable information for the development of mastery motivation and areas children need to be supported to develop internal motivation. When children are frustrated for example, when they fail to complete a task, rather than simply ignoring it, or getting upset with them, parents can implement proper guidance to adjust the level of difficulty

of the task and help children review the steps they are taking to solve the task and keep trying till children themselves are satisfied with the result. It is important to guide children to own their own learning process and to do it for themselves other than pleasing a parent. Similar approaches can be implemented by early childhood education teachers in classrooms. Furthermore, Turnbull et al. (2022) suggested that when families routinely play with their children, engage in art activities, read to them, and engage in community activities their children are more ready for school. Even though it is obvious that all these activities can be seen as crucial for motivation and learning, what needs to be noted is that these activities were family routines, meaning that they were part of a family life. Hence, it is important to create an atmosphere at home where learning is part of everyday activities, not something to be separated from daily routines.

Mastery motivation is a bridge between parenting style and children's academic achievement. Thus, teacher preparation programs, and the projects that are designed to educate parents and teachers about young children should emphasize that being involved in children's schooling and supporting children's education does not mean engaging only in traditional educational activities. Rather, empowering children, taking a whole child perspective, using daily activities, play and children's curiosity can all support children to be eager to learn and master their environment and experiences. We know that adults who employ mastery-oriented practices will help children to develop more positive attitudes toward their schooling (Pomerantz et al., 2006).

Although this study has shown that early mastery motivation is an important predictor for children's readiness to learn and parents play a significant role in children developing mastery motivation, there were still several limitations. Future research should focus more on identifying more specific daily activities parents practice at home, not just parenting styles and follow children throughout later school years. In addition to daily activities at home, parental goals and expectations, value they place on children's learning and development, and how they view their role in their children's learning can give better insight into parent related dynamics that influence mastery motivation and school readiness. Moreover, self-regulation is another important factor that received scholarly attention that affects children's readiness and achievement (See Blair & Diamond, 2008; Blair & Raver, 2015; Duncan, et al., 2018). Future research that explores the interaction between self-regulation and mastery motivation as well as family dynamics would help clarify our understanding of how parenting would influence children's inner resources that govern how children approach and cope with new challenges and experiences and how children's path to successful school experiences are paved. Furthermore, this study did not focus on any of the school related factors that could help children develop mastery motivation and be better prepared for formal schools. Thus, it is important future research that focuses on school related factors as well such as teacher-child interaction, teacher's efficacy skills and expectations, curriculum implemented at schools and material resources schools have. Finally, although including both mothers and fathers is a strength of the present study, the data were collected through self-report instruments. Future research that includes multiple approaches such as observations, interviews and focus groups can provide

valuable information on ways in which parents support children's development and learning.

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Çocukların Başarı Motivasyonunun Ebeveynlerin Çocukların Öğrenmeye Hazır Oluşuna Etkisinde Aracı Rolü: Yapısal Eşitlik Modeli

Öz

Bu araştırma ebeveynlerin çocuk yetiştirme stilleri ve çocukların öğrenme motivasyonlarının okul-öncesi döneminde bulunan çocukların okula hazır bulunuşluğuna etkisini incelemek üzere tasarlanmıştır. Araştırmaya dahil edilen iki yüz otuz iki çift anne-babadan sosyo-ekonomik durumları, çocuk yetiştirme tarzları ve çocuklarının başarı motivasyonuna dair bilgi edinilmiş. Çocukların sınıflarında bulunduğu erken çocukluk eğitimcileri ise çocukların okula hazır bulunuşluklarını beş ayrı alanda (fiziksel iyi oluş, duygusal olgunluk, sosyal yetkinlik, dil ve bilişsel alanda yetkinlik ve iletişim ve genel bilgi) değerlendirmiş, ayrıca başarı motivasyonu ölçeğini de doldurmuştur. Yapısal eşitlik modeline göre incelenen araştırma verilerinin sonucunda başarı motivasyonunun çocukların okula hazır bulunuşluğunu pozitif yönde yordadığı, ayrıca başarı motivasyonun çocuk yetiştirme stillerinin okula hazır bulunuşluğa olan etkisinde aracı rolü oynadığı görülmüştür.

Anahtar Kelimeler: Başarı motivasyonu, okula hazır bulunuşluk, çocuk yetiştirme stilleri, okul-öncesi çocukları

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The Role of a Virtual Internship in Developing Preservice Teachers' Technological Pedagogical Content Knowledge

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Abstract

Virtual internships are new areas of research in teacher education. They provide authentic contexts to foster complex professional thinking. Furthermore, they embody the essential elements of learning-technology-by-design approach, which is believed to be the most effective method to develop teachers' technological pedagogical content knowledge (TPACK). This study, conducted in 2018, examined the effectiveness of a virtual internship to develop preservice teachers' TPACK employing a quasi-experimental research design aided by qualitative data. The participants were seventy-four preservice teachers from a variety of majors. Data were collected using a self-report survey adapted from the Survey of Preservice Teachers' Knowledge of Teaching and Technology and the reflections written by the participants. The results indicated no statistically significant differences in the TPACK survey scores between the experimental and the control group participants. However, the experimental group significantly increased their TPACK scores in all TPACK sub-domains, except the content knowledge. The qualitative analysis based on participants' reflections supported the findings from the quantitative analysis by providing confirming evidence for the effectiveness of virtual internships in preservice teacher education.

Keywords: Technological pedagogical content knowledge (TPACK), technology integration, virtual internships, epistemic games, preservice teachers

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Introduction

Technological Pedagogical Content Knowledge (TPACK) is a conceptual framework describing the types of knowledge teachers need for technology integration (Mishra & Koehler, 2006). It builds on Shulman's (1986, 1987) conception of pedagogical content knowledge (PCK), underlying the idea that the relationship between content and pedagogy is as important as they are separate. Effective teachers need to be occupied with both content and pedagogy by making the aspects of subject matter more teachable (Shulman, 1986).

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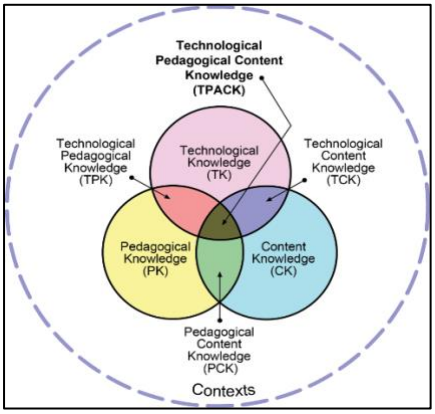
According to Mishra and Koehler (2006), the prominence of new technologies in educational practice is a big change. They are candidates for playing an essential role in changing the nature of classrooms by offering a variety of representations, analogies, examples, explanations, and demonstrations assisting to make content more understandable to learners as mentioned by Shulman in 1986. Mishra and Koehler introduced the TPACK framework putting the knowledge of content, pedagogy, technology at the center of teaching. The focus of the TPACK framework is on the connections, interactions, affordances, and constraints between and among these knowledge bases rather than considering them as separate bodies of knowledge. This way of thinking resulted in the following types of knowledge: pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and finally the interplay between all of them, technological pedagogical content knowledge (TPACK) (Figure 1).

Figure 1

TPACK Framework Categories (reproduced by permission of the publisher, © 2012 by tpack.org)



Content knowledge (CK) can be explained as the quantity and organization of the actual subject matter that is to be learned or taught. It is the knowledge assumed to be known and understood by teachers such as key facts, conceptions, theoretical information, and methodologies in a particular field; knowledge of explanatory frameworks organizing and connecting ideas; and knowledge of the rules of evidence and proving (Mishra & Koehler 2006; Shulman, 1986). Pedagogical knowledge (PK) represents the knowledge of procedures and methodologies that one uses during the teaching and learning processes. PK is related to all matters of how students learn, managing a classroom, developing and implementing lesson plans, and assessing students. PCK was described by Shulman (1986) as the knowledge that is the most germane in a particular subject matter for teaching. Technological knowledge (TK) can be explained as knowing how to utilize standard technologies like books, black, and chalkboards, as well as more advanced technologies such as the Internet and interactive whiteboards. TCK is the

knowledge of how to compose representations in a subject area by making use of technologies. TPK is about the knowledge of various technologies teachers benefit for pedagogical purposes during learning and teaching processes. It includes knowing the presence, elements, and potentials of these technologies and also knowing how their use might have potential influences on the teaching process. And finally, TPACK is a type of knowledge that "requires an understanding of the representation of concepts using technologies, pedagogical techniques that use technologies in constructive ways to teach content, knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face, knowledge of students' prior knowledge and theories of epistemology, and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones" (Mishra & Koehler, 2006, p. 1029). TPACK requires fully understanding the interweaving and complex relationships between the three major sources of teacher knowledge.

Researchers have suggested several ways to help teachers develop TPACK. These methods involved the use of TPACK-based courses (Albion, 2012; Niess et al., 2010; Tanak, 2020; Tyarakanita et al., 2020) or technology courses as part of cultural exchange programs (Dalal et al., 2021), courses specifically focusing on lesson plan designs (Chai et al., 2010; Guzey & Roehrig, 2009; Harris & Hofer, 2011; Koh & Chai, 2014; Njiku et al., 2021; Polly, 2011), intervention programs providing teachers technology integration opportunities in their classes (Jaipal-Kamani & Figg, 2015; Koh & Divaharan, 2011), and strategies combining more than one method (Jang, 2010; Mouza et al., 2014).

Most notably, however, Koehler et al. (2007) advocated the use of design-based activities in order to develop TPACK. In this learning-technology-by-design approach, the general guideline is to have teachers enact on an authentic professional action, such as designing materials or activities for their own classrooms, to develop their TPACK. While some researchers state that it is not clear what makes this strategy successful, there is a general agreement among researchers on its effectiveness (Voogt et al., 2016). Therefore, it is important to focus on the critical elements of this approach to suggest effective learning environments for TPACK development.

Virtual Internships/ Epistemic Games

One novel approach that can effectively support TPACK development of preservice teachers is virtual internships. This is because they also embody the elements of authenticity, small group collaboration, and design task - the three essential characteristics of the learning-technology-by-design-approach (Oner, 2020). Virtual internships in general aim to provide authentic contexts to foster complex professional thinking. In a virtual internship, learners collaboratively work on authentic tasks in small teams, and interact with mentors in a simulated online environment. In this environment, they are given the identity of actual interns of a specific profession.

Virtual internships are based on the epistemic frame theory, and thus, also called epistemic games (Shaffer, 2004, 2006, 2007, 2012). Epistemic frame theory argues that it is not just the amount of knowledge that makes up expertise in any given profession. It is the connections and configurations among different knowledge bases, which make up the epistemic frame of a profession –a construct similar to TPACK (Oner, 2020). Thus, virtual internships can be defined as computer-based practicum simulations designed to support the development of the epistemic frame of professional practice. More specifically, they aim to use the theory to transform the actions taken by the learner into a practicum experience within a digital learning environment. Therefore, they link the resulting game activities to the desired outcomes of an epistemic frame, which combines knowledge, skills, identity, values, and epistemology of a profession (Shaffer, 2006). Normally, this process advances gradually through a professional practicum in which a student takes part in a controlled environment and makes reflections on the consequences with mentors and peers (Shaffer et al., 2009).

Within the last decade, several virtual internships have been developed and assessed, such as the Pandora Project, Land Science, Escher's World, and Nephrotex, at the Epistemic Analytics Lab. These proved to be successful in developing complex thinking in areas such as mathematics, engineering, and urban planning (Arastoopour et al., 2014; Hatfield & Shaffer, 2006; Nash & Shaffer, 2012). However, they mostly addressed the STEM professions and used by high school students and engineering freshmen (Oner, 2020). Thus, the use of virtual internships in higher education is a new area of research.

More recently, a new virtual internship was designed by Oner (2020), namely the School of the Future (STF), for preservice teachers to develop their TPACK. Oner (2020) further analyzed preservice teachers' TPACK development using a network analytics method, namely the epistemic network analysis (Shaffer et al., 2016). Her analysis showed that at the end of the STF experience, preservice teachers' TPACK representations became more complex in terms of the number of pedagogical considerations and the strength of connections between technological, pedagogical, and content knowledge.

The present study tries to complement this line of work by investigating the effectiveness of virtual internships in preservice teacher education by using a self-report TPACK survey and participant reflections. More specifically, this study aims to support TPACK development with the implementation of a new virtual internship into an educational technology course offered as part of teacher education programs.

The research questions of the study are specified as:

(1) Do the preservice teachers who participate in a virtual internship (the STF group) differ from those who do not participate (control group) in their CK, PK, TK, PCK, TCK, TPK and TPACK scores over time?

(2) Is there a statistically significant difference between the pre- and post-TK, CK, PK, PCK, TCK, TPK and TPACK scores of the preservice teachers who participate in the virtual internship?

(3) How do preservice teachers' opinions on integrating technology into educational settings change as they participate in a virtual internship?

Method

This study employed a pre- and post-test quasi-experimental research design aided by qualitative data that were obtained from the participants' responses to a set of reflection questions. The qualitative data (reflections are written by the participants both at the beginning and at the end of the STF intervention) were used to complement and expand on the quantitative findings. Using qualitative data as an addition to quantitative data is accepted as a way to externalize the complex and multifaceted situations in learning and teaching practice (Chang et al., 2015).

Code of Ethics

This study has been reviewed and approved by Bogazici University SBB-EAK with the date and meeting number 04.04.2018, SBB-EAK 2018/39. Necessary permissions from the participants before data collection have been obtained.

Context and Participants

The study took place in the context of an educational technology course aiming to support preservice teachers' technology integration into their teaching at an English-medium university in 2018. The participants were preservice teachers who were in their junior or senior year from a variety of majors (see Table 1). Two sections of the course, taught by the same instructor, were randomly assigned as the experimental (STF) and the control groups. For the participants of the experimental group, participation in the virtual internship was a requirement of the course. However, participation in the study was voluntary and before data collection, ethical approval was granted by the institutional ethics committee.

Seventy-four participants, who gave informed consent, were involved in the study (see Table 1). A group of 26 participants from the STF group was randomly selected to answer the reflection questions.

Table 1

Number of Participants

Department	STF Group	Control Group	Total
Foreign Language Education	14	16	30
Mathematics Education	11	5	16
Science Education	6	8	14
Guidance and Psychological Counselling	7	7	14
Total	38	36	74

Intervention: School of Future Virtual Internship

The virtual internship 'School of the Future' (STF) was the primary intervention of the study. STF is a virtual internship program developed by Oner (2020) with the particular purpose of developing preservice teachers' TPACK. The intervention included an eight-week-long program that required students to participate in online STF sessions. The participation in the STF took place via two-hour-long online meetings during the class hours at a computer lab.

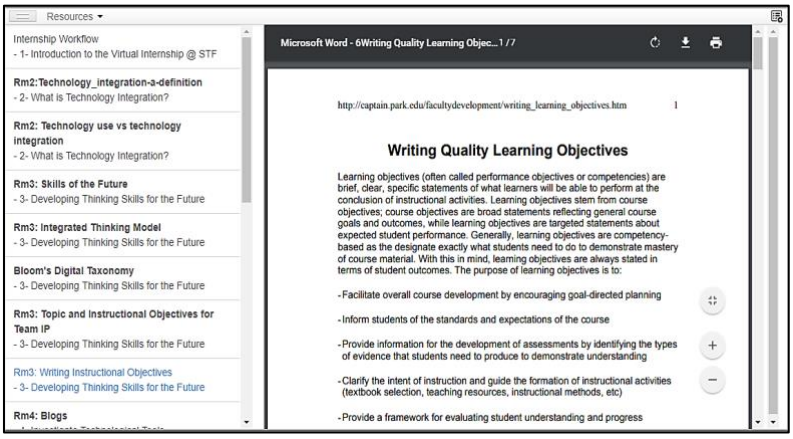
In STF, participants were addressed as intern teachers at a fictitious school (called the School of the Future) and asked to work on a major assignment throughout eight sessions: a collaborative instructional plan that integrates technology and that could be used by the STF teachers in the upcoming semesters. The participants from the same department were assigned to teams of four or five. Every week, teams worked on tasks that were designed to scaffold the final instructional plan project. During the online meetings, two graduate students (one of them being the first author), portrayed as mentor teachers at STF, facilitated the sessions by asking pre-prepared thought-provoking questions, providing explanations about that week's assignment, and technical help while maintaining team collaboration.

Weekly tasks required students to read assigned readings before and during the online meetings, prepare reports before meeting online, discuss questions posted by mentors synchronously during the online meetings, and submit notebooks (artefacts and reflections) during the online meeting or later -- all of which required them to consider and reconsider the connections between technology, pedagogy, and content that they needed to teach. An ordinary flow of STF participation is further explained below.

After login, interns see a pop-up screen indicating a new message from the STF coordinator about that week's assignment. The message informs the interns about the specific assignment, necessary resources, and notebook content they need to submit. The interns can access the resources by following the links in the message or using the resources tab on their screen (see Figure 2).

Figure 2

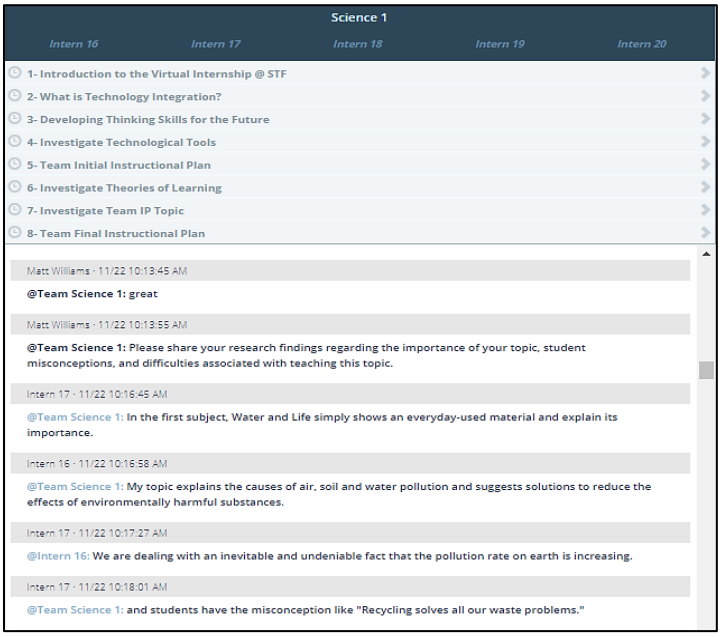
Resources Screen



Mentors interact with the team members during all online meetings via an integrated chat window (see Figure 3).

Figure 3

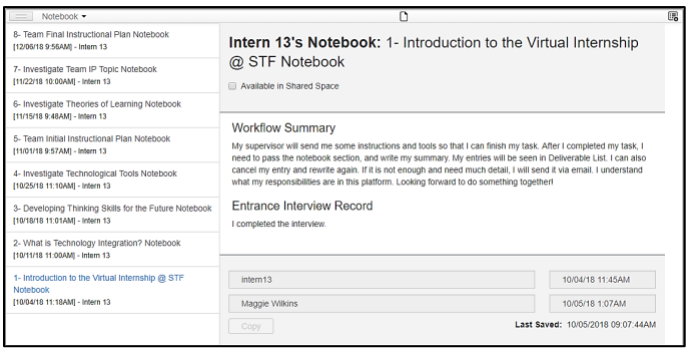
Online Chat Page of Teams



After each online meeting, team members need to individually submit a notebook, which includes deliverables showing their work on the tasks. An example of a notebook entry is the summary of the team discussion of a particular week (see Figure 4).

Figure 4

Notebook Screen of an Intern



The research team can display deliverables (notebook entries) on the STF mentor interface, evaluate them, and send feedback messages back to the interns on behalf of the STF program coordinator (see Figure 5). Example feedback messages are shown in Figures 6 and 7.

Figure 5

Mentor Screen for Viewing Deliverables (Notebooks)

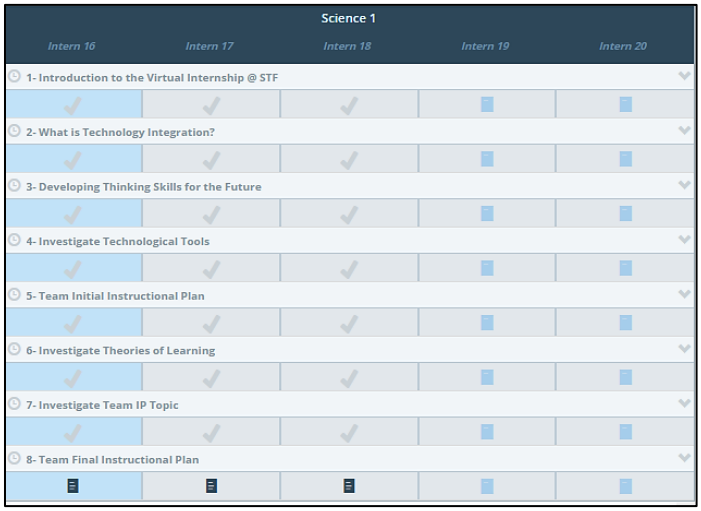


Figure 6

Feedback Screen 1

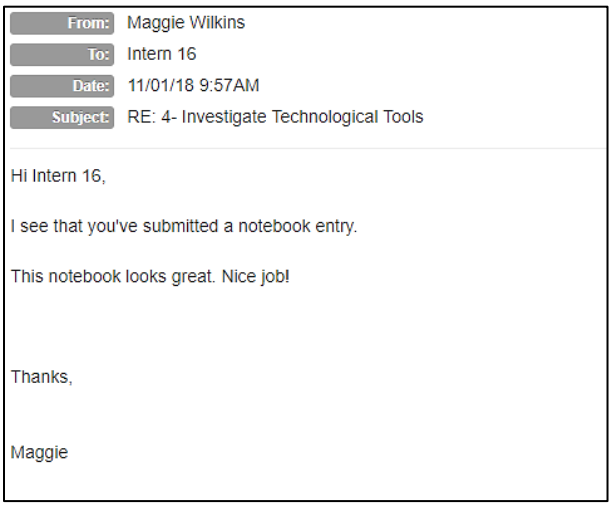
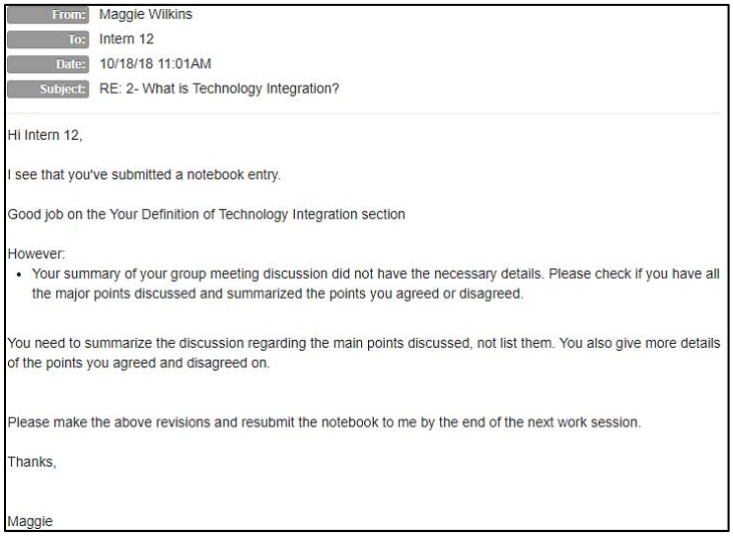


Figure 7

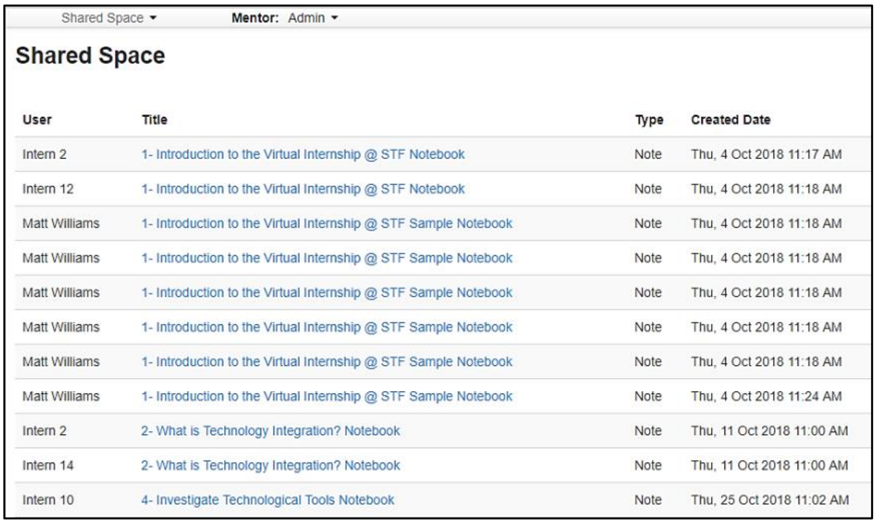
Feedback Screen 2



The interns can also share their deliverables on a shared space accessible to all STF participants (see Figure 8).

Figure 8

Shared Space


Shared Space ▾ Mentor: Admin ▾

Shared Space

User	Title	Type	Created Date
Intern 2	1- Introduction to the Virtual Internship @ STF Notebook	Note	Thu, 4 Oct 2018 11:17 AM
Intern 12	1- Introduction to the Virtual Internship @ STF Notebook	Note	Thu, 4 Oct 2018 11:18 AM
Matt Williams	1- Introduction to the Virtual Internship @ STF Sample Notebook	Note	Thu, 4 Oct 2018 11:18 AM
Matt Williams	1- Introduction to the Virtual Internship @ STF Sample Notebook	Note	Thu, 4 Oct 2018 11:18 AM
Matt Williams	1- Introduction to the Virtual Internship @ STF Sample Notebook	Note	Thu, 4 Oct 2018 11:18 AM
Matt Williams	1- Introduction to the Virtual Internship @ STF Sample Notebook	Note	Thu, 4 Oct 2018 11:18 AM
Matt Williams	1- Introduction to the Virtual Internship @ STF Sample Notebook	Note	Thu, 4 Oct 2018 11:18 AM
Matt Williams	1- Introduction to the Virtual Internship @ STF Sample Notebook	Note	Thu, 4 Oct 2018 11:24 AM
Intern 2	2- What is Technology Integration? Notebook	Note	Thu, 11 Oct 2018 11:00 AM
Intern 14	2- What is Technology Integration? Notebook	Note	Thu, 11 Oct 2018 11:00 AM
Intern 10	4- Investigate Technological Tools Notebook	Note	Thu, 25 Oct 2018 11:02 AM

Data Sources

The TPACK Survey

The quantitative data were gathered using an adapted version of the Survey of Preservice Teachers' Knowledge of Teaching and Technology (the TPACK survey in short) (Schmidt et al., 2009), which was presented to the participants as the entrance and exit interviews required by STF. The TPACK survey was adapted by adding parallel items for the foreign language education and psychological counselling and guidance departments by taking expert opinions (two faculty members from the foreign language education and psychological counselling and guidance departments) and excluding the items for the social sciences department. For example, item 17 was constructed as “I can use a scientific way of thinking” for the participants from the science department, whereas it was “I can use a way of thinking used by counsellors” for the participants from the guidance and psychological counselling department.

The adopted TPACK survey included six items for TK, three questions for CK (arranged for each department- Mathematics, EFL, Science/ Physics/ Chemistry, Guidance, and Psychological Counselling), seven items for PK, four items for PCK, four items for TCK, nine items for TPK, and four items for TPACK. The final version of the survey included 55 items, nine of them asking demographic information. It has a 5-point Likert-scale ranging from strongly disagree to strongly agree as to the original survey.

To assure reliability, Cronbach's alpha values were calculated based on the data of 62 preservice teachers, different from the study participants, who took the adopted TPACK survey. The results indicated that the Technological Knowledge (TK) subscale had a Cronbach's alpha of .85, the Content Knowledge (CK) subscale had a Cronbach's alpha of .96 for mathematics, .96 for science, .92 for guidance and psychological counselling, and .83 for EFL group. The Pedagogical Knowledge (PK) subscale had a Cronbach's alpha of .86 and the Technological Pedagogical Content Knowledge (TPK) subscale had a Cronbach's alpha of .92. A Cronbach's alpha value could not be calculated for the PCK, TCK, and TPACK since these subscales involved single items.

Reflection Questions

To collect qualitative data, participants were given some reflection questions before and after the STF treatment. In this study, we particularly analyzed the answers given to the following reflection questions: (1) How could technology be effectively integrated into a lesson plan in your field? Please exemplify. (2) Could you state the cases that integration of technology into the instruction would be appropriate and not appropriate? Please exemplify.

Data Collection

The data were collected throughout two semesters following the same procedures. The participants, as intact groups of two sessions of the course, were randomly assigned to the experimental (STF) and control groups. Both groups were administered the adopted TPACK survey at the beginning of the semester. Pre-intervention reflection questions were also given to 26 STF participants, which were determined randomly. The experimental group followed the STF procedures online for eight weeks (see above), while the control group covered similar content in a regular class environment.

The typical lesson activities of the control group involved completing and discussing weekly assigned readings (same as in the STF group), sharing their personal opinions on the use of technology in K12 education, and posting reflections on their web-based portfolio. They also worked on developing technology-integrated lesson plans to provide meaningful learning with technology.

At the end of the intervention, both groups were administered the same TPACK survey. Additionally, the same group of the 26 STF group participants, who also had replied to the pre-intervention reflection questions, responded to the same reflection questions.

Data Analysis

The survey data were analyzed through quantitative methods. For each participant, the mean scores for each of the TPACK components as pre- and post-intervention scores were calculated. To answer the first research question, a two-way mixed design MANOVA test was used. Before conducting the test, nine assumptions of the two-way

MANOVA were checked to satisfy the requirements of the test (i.e., the dependent variables measured at interval level, the independent variables consisting of two categorical groups, the independence of observations, adequate sample size, no univariate or multivariate outliers, multivariate normality, a positive linear correlation between each pair of dependent variables for all combinations of the two independent variables, homogeneity of variance-covariance matrices, no multicollinearity).

To answer the second research question, a separate one-way repeated measure MANOVA test was used to examine the differences between the TPACK sub-scores of the STF group over time. Before conducting the MANOVA test, the assumptions were checked again on the STF data. Determining the main effect (time) on the dependent variables, univariate follow-up ANOVA tests were performed to determine which TPACK sub-scores differed in time, using the Bonferroni adjustment. As the time factor involved only two levels (pre and post), further t-tests were not performed.

To answer the third research question, the reflection data were organized using an Excel sheet. After a preliminary exploratory analysis of the pre- and post-intervention reflection data to obtain a general sense of the whole data, the data were coded qualitatively. This involved dividing the reflection data into meaningful units, which involved one particular issue (Merriam, 1998), and using the constant comparative data analysis method (Glaser & Strauss, 1967). The major themes underlying participants' responses to the reflection questions were determined. The most prominent themes and the number of the participants who highlighted these themes were compared and contrasted in two reflection data sets (pre- and post-intervention) to provide a complementary understanding of participants' TPACK development. While the first author coded the qualitative data, the second author (the thesis advisor) constantly checked the validity of the codes. Furthermore, the qualitative findings were triangulated with quantitative data.

Results

Difference between STF and Control Groups

Descriptive statistics for the STF and the control groups indicated that there were increases at the post mean scores for all the seven TPACK domains, without exception, in comparison with the pre mean scores of both groups. The gain scores (mean score differences) for all of the TPACK components, except for the CK, were higher in the STF group (see Table 2).

Table 2

Mean Score Differences (Post-Pre) of the Experimental and Control Groups

	STF			Control		
	Pre	Post	Gain Score	Pre	Post	Gain Score
TK	3.43	3.98	0.55	3.26	3.70	0.44
CK	4.31	4.39	0.08	4.23	4.38	0.15
PK	3.83	4.13	0.30	3.76	3.99	0.23
PCK	4.18	4.53	0.35	4.19	4.42	0.23
TCK	3.53	4.24	0.71	3.72	4.31	0.59
TPK	3.78	4.32	0.54	3.80	4.20	0.40

A two-way mixed design MANOVA, using Wilk's Lambda, revealed that there was not a significant interaction effect of time and group, Wilk's $\Lambda = .965$, $F(7, 66) = .344$, $p > .05$. Again, using Wilk's Lambda, there was not a significant main effect of group, Wilk's $\Lambda = .868$, $F(7, 66) = 1.432$, $p > .05$. However, the multivariate result was significant for time, Wilk's $\Lambda = .426$, $F(7, 66) = 12.684$, $p < .05$, partial $\eta 2 = .574$, indicating a meaningful difference in the pre and post TPACK domain scores with a large effect size (see Table 3).

Table 3

Multivariate Test Results for Wilk's Lambda[a]

Effect		Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial Eta Squared
Between Subjects	Intercept	.005	1772.947[b]	7.000	66.000	.000	.995
	Group	.868	1.432[b]	7.000	66.000	.208	.132
Within Subjects	Time	.426	12.684[b]	7.000	66.000	.000	.574
	Time* Group	.965	.344[b]	7.000	66.000	.931	.035

a. Design: Intercept + Group
Within Subjects Design: Time
b. Exact statistic

To summarize, the multivariate test result indicated that there was not a statistically significant difference in the TPACK domain scores between the STF and control groups. The analysis, however, revealed a statistically significant increase in the TPACK domain scores in time regardless of the group affiliation.

STF Group and TPACK Improvement

Using Wilk's Lambda, one-way repeated measures MANOVA test result revealed a significant time effect over the TPACK domain scores of the STF group, Wilk's $\Lambda = .346$, $F(7, 31) = 8.370$, $p < .01$, partial $\eta 2 = .654$, indicating a large effect size (see Table 4). That is, there is a statistically significant difference in the seven combined TPACK domains (TK, CK, PK, PCK, TCK, TPK, and TPACK) over time (after participating in the virtual internship).

Table 4

Tests of Within-subjects Effects [a, b]

Within-Subjects Effect		Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial Eta Squared
Time	Wilk's Lambda	.346	8.370[c]	7.000	31.000	.000	.654

a. Design: Intercept
Within Subjects Design: time
b. Tests are based on averaged variables.
c. Exact statistic

Since the MANOVA test was significant for time, the univariate test results were used to determine which dependent variables (TPACK domain scores) differed. A more conservative alpha level was applied using the Bonferroni adjustment ($\alpha = .007$), a divided α value by the number of dependent variables (seven in this case) to counteract the potential of an inflated Type I error rate due to multiple ANOVAs (Tabachnick & Fidell, 1996). The univariate ANOVA test results revealed that the pre and post TPACK scores of the STF group differed significantly for all the TPACK domains, except for the CK domain $F(1, 37) = .664$, $p > .007$ (see Table 5). As the time factor involved only two levels (pre and post), further t-tests were not performed.

To summarize, the STF participants significantly increased all of their TPACK scores, except the CK domain, in time. The qualitative analysis based on the written reflections presented below also supported the findings from the quantitative analysis by providing complementary evidence for the TPACK development of the STF group.

Table 5

Univariate Tests

Source	Measure	Type III Sum of Squares	*df*	Mean square	*F*	Sig.	Partial Eta Squared
	TK	5.825	1	5.825	45.800	.000	.553
	PK	1.823	1	1.823	13.723	.001	.271
	CK	.118	1	.118	.664	.421	.018
	PCK	2.224	1	2.224	9.941	.003	.212
	TCK	9.592	1	9.592	18.770	.000	.337
	TPK	5.470	1	5.470	54.964	.000	.598
	TPACK	4.750	1	4.750	16.349	.000	.306
Error (time)	TK	4.706	37	.127			
	PK	4.915	37	.133			
	CK	6.603	37	.178			
	PCK	8.276	37	.224			
	TCK	18.908	37	.511			
	TPK	3.683	37	.100			
	TPACK	10.750	37	.291			

Change in Preservice Teachers' Opinions about Technology Integration

Before the STF experience, the participants had more tendencies to benefit from technology as a source for teaching materials. As seen in Table 6, they generally perceived videos as easy-to-access materials to provide means when necessary teaching resources are not available, such as laboratory kits. One student stated that

> Most of the concepts of physics are observable and experimental. To make these concepts more understandable, if possible, it is best to conduct experiments in the classroom or laboratory, if not, the videos of these experiments can be viewed at the classroom. (Student 37, pre-intervention reflection)

One of the most notable changes in the written reflections regarding question 1 is that the number of the participants who declared online platforms as an effective technology integration method increased from two to 11 after the STF experience (Table 6). At the pre-intervention reflections, they described an online platform as an area that the teacher could share course materials and the students can share their homework and explorations about a subject. At the post-intervention reflections, however, they explained an online platform more of a medium that the students can share their ideas, make discussions, prepare portfolios (Student 25), make comments to each other's ideas by getting feedback from teachers (Student 27, Student 34, Student 35, Student 38), working on cooperative projects (Student 18), working on a problem via brainstorming studies (Student 38), creating discussion groups that would be time-consuming and hard

to compose in the classroom (Student 30). Thus, the post-intervention ideas included more emphasis on the learning methods, either individually or as a group.

Similarly, at pre-intervention, they mentioned computer-based simulations as an alternative in case of the absence of a laboratory and visuals as a way of representing abstract materials. On the other hand, at the post reflections, their statements were more mostly associated with integrating technology as a tool. The number of participants who considered different technologies simply as containers of knowledge notably decreased in the post reflection data. In addition to an increase in the number of the ideas about the effective ways of technology integration in a lesson plan, the computer-based tools became more diversified with the addition of using slide shows, implementing technologies that support multiple learning approaches and assessment that can be performed with the help of the Internet.

Table 6

Preferred Technological Tools for Teaching

	Pre STF	Post STF
Themes	# of the Participants	# of the Participants
Video	10	3
The Internet	7	1
Visualization	6	3
Educational games	5	1
Simulations	4	4
Applications	4	9
Online platforms	2	11
Online courses	2	-
Slide shows	-	7
Multiple learning approaches	-	3
Internet evaluation	-	2
Total	40	44

One of the most notable differences between the pre- and post-intervention reflection statements is related to teacher control when using technology in the classroom. The number of participants who thought that technology integration should have been under the teacher's control decreased from 6 to 1 at the post-intervention reflections (see Table 7). At the pre-intervention, participants' concern about technology integration was mostly about the possible challenges technology could bring along such as difficulties in classroom management (Student 25, Student 33, Student 35) and distraction of students at young ages (Student 18, Student 38). This concern of the participants indicates that they were overly stressed about the use of technological devices, without considering their potential for pedagogical purposes. However, at the post-intervention, more references were made to using technology as a tool instead of using it for its own sake (see Table 8). One student (Student 27) stated that "The goal should not be learning the technology itself. It can distract students from the lesson." Also, another (Student 18)

said that "Learning technology is not a goal for us, we should benefit from it as a tool when we want to present a material or make some applications otherwise we would not be able to do."

Table 7

Reflection Themes before STF

Technology integration is appropriate		Technology integration is not appropriate	
Themes	# of the Participants	Themes	# of the Participants
Under teacher's control	6	Not used for its own purposes	4
Provided training for its use	5	Used for its own sake	4
Used as a tool	4	Not applicable to certain lessons	3
In any case	4	Equal access to technology is an issue	2
Supports multiple learning styles	2	Takes the place of a teacher	1
For saving of time	2	Students not familiar with technology	1
For distance learning	1	Students bring their own technology	1
Total	23		16

Table 8

Reflection Themes after STF

Technology integration is appropriate		Technology integration is not appropriate	
Themes	# of the Participants	Themes	# of the Participants
Used as a tool	6	Used for its own sake	6
In any case	4	Students not familiar with technology	5
To enhance student motivation	2	Teachers not familiar with technology	3
As an assistance to reach objectives	1	Distracting attention	3
Under teacher's control	1	Equal access to technology is an issue	1
For saving of time	1	Not applicable to certain lessons	1
Total	1		19

The analysis of the reflection data suggests that, after the STF experience, the participants started to think about technology as a tool for meeting instructional objectives with appropriate pedagogical methods rather than simply as a source of lesson materials and content. They became more articulate about the notion of technology integration as evident with more diversified ideas, by putting emphasis on meeting instructional objectives and using diverse pedagogical strategies rather than using technology for its own sake.

Discussion

The findings of the present study showed that the STF group had higher TPACK and TK, CK, PK, PCK, TCK, TPK score gains compared to the control group; however, the differences were not statistically significant. Further analyses indicated that the STF group significantly increased six of their TPACK scores (TK, PK, PCK, TCK, TPK, and TPACK), except one (CK), after the STF intervention. Also, the analysis of the pre and post reflections showed that the participants enhanced their understanding and conceptualization of technology integration, focusing more on the content-related learning outcomes with the use of diverse pedagogical strategies when using technology in classrooms.

Previous research on virtual internships typically relied on the analyses of large qualitative data sets (chat data of participants working in a virtual internship) and used a specific type of network analytics method, namely epistemic network analysis (Shaffer, 2017). This body of research manifested the effectiveness of virtual internships in knowledge development, content learning, making justifications and positive attitude development toward a subject (Arastoopour et al., 2014; Bagley & Shaffer, 2009; Bagley & Shaffer, 2011; Beckett & Shaffer, 2005; Chesler et al., 2013; Hatfield, 2011; Nash et al., 2012; Nash & Shaffer, 2012; Nulty & Shaffer, 2008; Shaffer, 1997; Svarovsky & Shaffer, 2006). However, our findings showed that, in the context of a quasi-experimental study, there were no statistically significant differences between the self-report based TPACK scores of preservice teachers who participated in a virtual internship and those who were in the control group.

The reason for this finding might be attributed to the similar course content and equally effective methods used in both groups. During the course, the control group also worked on collaborative class projects, producing instructional multimedia, and developing technology-integrated lesson plans. Thus, the control group also had several opportunities to develop their TPACK skills throughout the semester. Thus, it is reasonable to argue that the reason that the two groups did not differ significantly in their TPACK development is that both groups comparably improved their TPACK scores during the study. Further research including additional control groups based on more traditional instruction (if possible) could be suggested to examine the effects of virtual internships in teacher education from a quantitative standpoint.

The analysis also showed that the preservice teachers who participated in the virtual internship significantly improved their TPACK scores over time. That is, their self-report evaluations corresponding to all of the TPACK domains (except the CK) improved as a result of participating in a virtual internship. These findings of the present study provided complementary evidence on virtual internships being effective means of developing preservice teachers' TPACK (Oner, 2020). Oner's analysis showed that preservice teachers' TPACK network representations became more complex in terms of the strength of connections between technological, pedagogical, and content knowledge after using the STF. This study corroborates these findings by showing that preservice teachers' self-evaluations regarding their TPACK development also significantly improved with a virtual internship.

One of the issues that should be addressed is the non-significant CK development of the STF group while making statistically significant improvements in the other TPACK domains. The reason for no significant development in the CK domain might be due to the fact that the mean score (M = 4.31) for the CK domain was already high in the pre-test results. Indeed, the highest pre-test mean score of the STF group was the CK domain. Therefore, even if the participants benefited from the STF experience, it might not have shown up in the results in terms of CK development. Indeed, there is an increase in the CK mean score at the post-test (M = 4.39), while not being a statistically significant development. Further research could examine ways of increasing CK in the design of learning environments for TPACK development.

Furthermore, it should be noted that the STF is not designed to develop general content knowledge per se. Mishra and Koehler (2006) also argue that an educational program should not be intended to teach a particular content, pedagogy, or technology separately; rather, the interplay between them should be taken into consideration. STF provides a setting to study the content knowledge in the context of pedagogical and technological knowledge; therefore, it does not provide explicit opportunities for content knowledge development separately. To elaborate, in one of the STF assignments, teams were asked to discuss their final project topic (content) concerning its importance (why is it important for students to learn this topic) and possible misconceptions or learning difficulties connected with it. This assignment also required students to think about the teaching strategies that can be used to support student learning and to address the difficulties (make use of PCK) and how technology can help to support student learning and in addressing the difficulties associated with teaching this topic (make use of TCK and TPK). Thus, STF is not designed to provide opportunities for developing TPACK domains separately; rather, it aimed to provide opportunities for developing TPACK domains in an integrated manner.

This study differs from the most virtual internship-related studies by a sampling of college students. The majority of the previous studies sampled high school or middle school students (Bagley & Shaffer, 2009; Bagley & Shaffer, 2011; Beckett & Shaffer, 2005; Hatfield, 2011; Nash et al., 2012; Nash & Shaffer, 2012; Nulty & Shaffer, 2008; Shaffer, 1997; Svarovsky & Shaffer, 2006) to study virtual internships. In one of the studies that sampled college students, researchers worked with the

engineering students and demonstrated a significant increase in learning engineering content (Arastoopour et al., 2014; Chesler et al., 2013).

The TPACK improvement of the participants based on the survey data was additionally supported by the participants' reflection data. We found that preservice teachers started to bring in more ideas about the use of technology in relation to the teaching of certain content in terms of learning outcomes and various pedagogical methods. This finding provided further evidence for the effectiveness of virtual internships to develop preservice teachers' TPACK. However, further studies can be conducted to examine the effect of virtual internships in different university settings. In addition, researchers could investigate and compare the TPACK development of preservice teachers from different departments.

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Öğretmen Adaylarının Teknolojik Pedagojik Alan Bilgilerini Geliştirmede Sanal Stajın Rolü

Öz

Sanal stajyerlik uygulamaları, karmaşık profesyonel düşünceyi teşvik etmek için otantik bağlamlar sağlayan öğretmen eğitiminde yeni bir araştırma alanıdır. Ayrıca, öğretmenlerin teknolojik pedagojik alan bilgilerini (TPAB) geliştirmek için en etkili yöntem olduğuna inanılan tasarım yoluyla öğrenme yaklaşımının temel unsurlarını içerirler. 2018 yılında gerçekleştirilen bu çalışma, nitel verilerle desteklenen yarı deneysel bir araştırma desenini kullanarak öğretmen adaylarının TPAB'sini geliştirmek için sanal bir stajyerlik uygulamasının etkinliğini incelemiştir. Çalışmaya çeşitli bölümlerden yetmiş dört öğretmen adayı katılmıştır. Veriler, Öğretmen Adayları için Öğretim ve Teknoloji Bilgisi Anketi'nden uyarlanan bir öz bildirim anketi ve katılımcılar tarafından yazılan yansımalar kullanılarak toplanmıştır. Sonuçlar, deney ve kontrol grubu katılımcılarının TPAB anket puanlarında istatistiksel olarak anlamlı bir fark olmadığını göstermiştir. Ancak deney grubu, alan bilgisi dışındaki tüm TPAB alt alanlarında puanlarını önemli ölçüde artırmıştır. Katılımcıların yansımalarına dayalı nitel analiz, nicel analizden elde edilen bulguları destekleyerek, hizmet öncesi öğretmen eğitiminde sanal stajyerlik uygulamalarının etkililiğine dair doğrulayıcı kanıtlar sağlamıştır.

Anahtar Kelimeler: Teknolojik Pedagojik Alan Bilgisi (TPAB), teknoloji entegrasyonu, sanal stajyerlik, epistemik oyunlar, öğretmen adayları

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The Relationship between the Quality of Early Childhood Education and Socioeconomic Background of Children

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Abstract

The quality of early childhood education (ECE) schools and classrooms have been studied by many researchers. The results indicated that there is a considerable gap in terms of quality among ECE schools and classrooms. There is inequality among children from diverse socioeconomic backgrounds in attending high-quality ECE. It is known that a high proportion of the child population is currently attending public ECE schools. Therefore, the current study aims to get comprehensive data about the quality of public ECE classrooms and descriptive data about children's socioeconomic backgrounds. Based on this, the current study aims to assess whether there is a relationship between these two factors and whether there is a gap among children in terms of reaching high-quality public ECE. This study is correlational research. The Non-random purposive sampling method is used for the data collection. The results show that there is a significant positive correlation between parents' socioeconomic factors and the quality of ECE classrooms. The study contributed to the ECE literature by identifying the factors related to children, parents, teachers, and the quality of ECE classrooms. There is a need for further research in Turkey that defines and investigates the quality of ECE from a multidimensional perspective and particularly including families, schools, educational programs, and culture.

Keywords: Early childhood education, quality of education, young children

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Introduction

Since the beginning of the twenty-first century, educational specialists and policymakers globally have paid more attention to education, especially in early childhood years. Scientists in the fields of education, psychology, and other related areas conduct numerous applied research to gain insight into factors that have long-standing impacts

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on child development and bring people's attention to the issue. As Abbott (2014) suggested, high-quality education beginning from the early years of life is vital to be successful in the twenty-first century as it helps individuals to develop skills that are content knowledge and 21st-century themes; learning and innovation skills; information, media and technology skills; life and career skills (The Partnership for 21st Century Learning, 2015).

In the year 1995, The National Association for the Education of Young Children Governing Board set goals related to early childhood education and its long-lasting impacts on later in life. In Goal I, The Board focused on the importance of early years for children's readiness of learning in school stating: "all children will start school ready to learn" (NAEYC Governing Board, 1995). In 2001, the United States did an educational reform named as No Child Left Behind Act. This educational reform aimed to improve the quality of education not only for individual children but also for the welfare of society (U.S. Department of Education, 2005). Rhode Island KIDS COUNT (2005) also pointed out the importance of making investments in the early years to have children who read successfully, healthy teens, and productive adults. In this regard, Heckman (2006) found that investing in early childhood education provides higher returns for society, families, and individuals sustainably and comprehensively. These global educational trends have led to some educational changes in Turkey as well.

From the beginning of the 21st century, the Turkish Ministry of National Education has started to give more importance to public early childhood education to provide center-based education services for children and their families (MoNE, 2021). Turkish MoNE had worked very hard to make public early childhood education compulsory and wider for 5- and 6-years old children before the introduction of a new educational system "4+4+4" in 2012. To do this, the number of public early childhood education schools and classrooms was increased. The aim was to make the rate of schooling in early childhood education increase from 12% to 25%. However, the rate of schooling in early childhood education increased to 16.1% in the year 2005 (Derman & Başal, 2010). In 2009, educational policymakers underlined the importance of attending a public early childhood education program for young children, especially for five years old children before elementary education (60-72 months). With these policies, early childhood education schooling and enrollment rates for young children have increased dramatically. However, the Turkish MoNE has been criticized for not emphasizing early childhood education sufficiently after the new educational system of 4+4+4 (Anne Çocuk Eğitim Vakfı [Mother Child Education Foundation] [AÇEV] & Eğitim Reformu Girişimi [Education Reform Initiative] [ERG], 2013). Within the regard of this new educational system, attending early childhood education was not compulsory for children before elementary school. Parents had to register their children to the first grade when their children reached 66 months of age. Additionally, families had the option for registering their children to early childhood education or registering them to the first grade if their children were between 60 and 66 months old (MoNE, 2012). Within this regard, families mostly choose to register their children to elementary school instead of early childhood education because of financial issues (AÇEV & ERG, 2013; AÇEV & ERG, 2016). Therefore, the schooling rates and the enrollment rates to center-based

early childhood education programs have dropped down to be lower than the rates of the year 2013 (MoNE, 2021). However, the schooling rates and the number of children who attend early childhood education began to increase dramatically after the 2014 year.

Although there are several factors influencing why early education is receiving greater attention, there is one main reason for this. The reason is that findings of applied research have documented clearly that the experiences and environment of children's early childhood years have substantial effects on children's readiness for school and achievement throughout their education and life (Romano et al., 2010; Pianta et al., 2002). In Canada, a nationwide school readiness survey was applied to see the importance of children's school readiness for their later education life (Romano et al., 2010). At the end of this nationwide survey, Canadian educational scientists found that kindergarten math, reading, and socioemotional skills are predictors for 3rd-grade school achievement. They also found that there is a strong positive correlation between early and later socioemotional skills of children (Romano et al., 2010). In the United States, educational specialists and policymakers conducted an Early Childhood Longitudinal Study between the years 1998-2000 to assess children's readiness for school and to see the effectiveness and appropriateness of early childhood education for children's later achievement. They used a large sample to collect data from early childhood education schools and elementary schools. Findings of this research suggest that children who have multiple risk factors have lower points than children who have no risk factors in terms of reading and mathematics skills, general knowledge, motor skills, and social skills, and they show fewer positive attitudes towards learning activities (Denton & West, 2002; U.S. Department of Education & National Center for Educational Statistics, 2001).

Although the quality of ECE is receiving greater attention more recently, there has been some applied research on the quality of ECE in Turkey. Like the rest of the world, researchers in Turkey are also trying to clarify factors that are significantly related to the quality of ECE as well as how the socioeconomic backgrounds of children are associated with the quality of ECE (Adagideli, 2018; Cinkılıç, 2009; Erkan & Kırca, 2010; Erkan, 2011; Gündüz & Çalışkan, 2013; Tozar, 2011; Yazıcı, 2002). Those studies have shown that there is a strong positive relationship between the quality of ECE and the socioeconomic status of children's families. Those empirical research provide evidence that is crucial and has great potential to impact early childhood education policies in Turkey in terms of making center-based publicly supported ECE programs and services wider, more accessible, and of higher quality.

With the consideration of the educational system in Turkey that does not include early childhood education within compulsory education, it is essential to conduct research that assesses the relationships between the quality of public early childhood education programs and the socio-economic background of children, because majority of the children (91.6 %) who are attending ECE programs in Turkey are currently attending public ECE classrooms and schools. (MoNE, 2021). This way, policymakers can be informed about the significance of early education and development for later school achievement.

Early Childhood Education in Turkey

In Turkey, processes of determining and applying educational standards, policies, and aims are carried out by the National Ministry of Education (MoNE, 2013). Therefore, educational activities about early childhood are under the responsibility of MoNE. According to MoNE (2013), early childhood education programs are for children between 36 and 66 months and attending an early childhood education program is optional in Turkey.

The general aims and the principles catalog of MoNE (2013) suggest the aims of early childhood education in Turkey: preparing children for elementary school, encouraging children's creativity and analytical thinking, supporting children's whole development, supporting children from disadvantaged backgrounds, making children respectful to differences, and encouraging children to learn reforms and principles of Mustafa Kemal Atatürk. It was emphasized that these essential aims should be provided through a child-centered approach considering children's age-related characteristics, concerns, needs, individual characteristics, individual differences, and environmental factors. Also, MoNE stated that it is essential for children to gain specific achievements that are comprehensive and appropriate for children's developmental levels. The educational program should be flexible for children's diversities, and it should be applied appropriately. The program provides independence for teachers in teaching. Also, the program aims to make assessment and evaluation more comprehensive. The Ministry of National Education suggests that the ECE program of Turkey prepared by the ministry itself identified certain developmental achievements and indicators for children considering children's ages and different developmental domains so that teachers can prepare lesson plans and provide experiences for children and assess children's developmental process appropriately. Furthermore, it emphasized the importance of providing young children with high-quality early childhood education with physically, cognitively, and socioemotionally rich environmental stimuli for children to have positive experiences that would foster positive attitudes towards learning.

In the catalog published by MoNE, preschools are defined as schools for children who are between 36 and 66 months, and preschool classrooms are defined as classrooms that provide formal education to children between 36 and 66 months of age (MoNE, 2013). In this catalog, types of early childhood education institutions were divided into three categories. These were: independent preschools, preschools that are bounded to public primary education schools, and educational practice classrooms that are bounded to other educational organizations.

There has been an increase that ECE received since the establishment of the Turkish Republic, peaking especially in 2009 because MoNE announced that attending ECE was mandatory for children who are between 5 and 6 years of age (Derman & Başal, 2010). However, a new educational system (4+4+4) was accepted in the spring semester of the 2011-2012 educational year and was launched in the fall of 2012. In this

system, the first eight years of education are defined as primary education (the first four years were a primary school and the second four years were middle school), and the last four years of the compulsory education system are named high school education. It is explained in the guidebook of the new educational system that early childhood education is for children who are 36 to 66 months old, but it is not compulsory. Children who are 66 months old have to begin elementary school, but families whose children are between 60 and 66 months old have an option to register their children to elementary education or early childhood education based simply on their preference (MoNE, 2012). Although attending an early childhood education program was made optional for young children in the new educational system, The Ministry of National Education stated that it was its aim to make formal early childhood education accessible to the whole country for children who are between the ages of 3 and 5. In 2016, The Turkish government announced that attending formal early childhood education would become compulsory for five years of children in the 2019 year. However, this policy was begun to be implemented in 22 pilot provinces that have already high enrolment rates for early childhood education. In conclusion, families from disadvantaged backgrounds were not benefited from this policy (Göl-Güven, 2018). In accordance with the concerns that these changes were going to negatively affect the schooling attendance rates of young children in preschools in Turkey, the rate of increase had dropped down after the change in the educational system in 2012. However, according to the recent statistics of MoNE (2020), the number of students who attend early childhood education has begun to increase again in the 2014 year as a result of increasing the age of primary school enrollment to 66 months.

There have been a number of criticisms from educational specialists and organizations in Turkey regarding the approval of the new educational system (4+4+4). According to the report of AÇEV and ERG (2013), a new educational system may cause inequalities among children because socioeconomically disadvantaged children may not have a chance to attend preschools when they are not provided by the government free of charge. It is known that early childhood education is expensive in private education centers. Families who have better socio-economic opportunities can afford to register their children in private early childhood education centers. Most families choose to register their children in public education schools, because of the lower educational fees. Even though these amounts of the educational fees are lower than in private early childhood education schools, these amounts are high for families from lower socioeconomic status (Karlıdağ-Dennis et al., 2022).

In the educational system of Turkey, early childhood education is not compulsory and public early childhood education programs take some educational fees from families based on the educational expenses of the schools. Consequently, families with low socio-economic status choose to register their children for first grade when they become 60 months old. Children begin school without readiness for learning in terms of whole developmental domains. This makes the achievement gap between children wider (AÇEV & ERG, 2013; AÇEV & ERG, 2016; Karlıdağ-Dennis et al., 2022).

To conclude, policies governing the state of ECE in Turkey are constantly changing and making it very difficult for children, parents, and teachers to adjust. In fact, these structural changes in the system seem to take all the attention and, as a result of this, improving the quality of early childhood education becomes somewhat of a neglected phenomenon. Therefore, it is still unknown how the quality of public early childhood education institutions is and if and how young children who attend such institutions are ready to learn at school.

The Quality Term in Early Childhood Education Settings

Quality of early childhood education is vital for children's development. When schools meet children's needs and expectations, children can feel belonging to their school and have better relationships in the classroom. Also, in high-quality early childhood education schools, children have opportunities to acquire meaningful learning (AÇEV & ERG, 2016; NAEYC, 1995; NICHD Early Child Care Research Network, 2002).

Different quality standards are set by educational specialists and educational institutions including physical properties of the learning environment (teacher-child ratio, equipment of class, and educational materials), teachers (teacher features, pre-service, and in-service training), school administrators, education program, community and family involvement to the education process, socio-emotional process (teacher-child and child-child interactions), features of staff, and health-nutrition-security services of institutions (AÇEV & ERG, 2013; NAEYC, 2005; NICHD Early Child Care Research Network, 2002).

Kıldan (2010) divided quality standards of education into two dimensions: Physical Equipment and Environment Quality, and Pedagogical Quality. According to Britto and Limlingan (2012), physical environment quality is significant for the safety and health of children and adults. Researchers and educational specialists suggest that schools should have areas that support children's physical development both indoors and outdoor spaces of the school area (Britto & Limlingan, 2012; Kıldan, 2010; MoNE, 2013). While building these places, space for movement, safety, and health of children, active Engagement of children, and the quality and the quantity of the materials should be considered. Moreover, an early childhood education school should be in an appropriately accessible location. This is important for children's safety and accessibility to school.

In terms of pedagogical quality, Britto and Limlingan (2012) emphasized that the educational experiences of teachers are linked to the quality of education and learning of children. Therefore, it is vital to have teachers who are specifically trained in the early childhood education field for children's sustainable and appropriate learning. Also, Kıldan (2010) suggested that having an academically and socially effective curriculum is an indicator of high-quality education. Ponitz, Rimm-Kaufman, Grimm, and Curby (2009) emphasized that educational activities should be comprehensive and should touch all developmental domains to support the development of children so that they can have better learning and achievement.

According to research, the quality of education is positively associated with the developmental outcomes of children (NAEYC, 2005; NICHD, 2006; NICHD Early Child Care Research Network, 2002). In fact, as Fryer and Levitt (2004) suggested, the quality of schools, especially early childhood education schools, may have a crucial role in closing the achievement gap between children who come from various backgrounds, particularly those from disadvantaged environments. However, the results of the research showed that more students in a class are positively associated with a less child-centered climate in the classroom, the income level of families is positively correlated with attending a higher child-centered climate, and higher levels of mother's education are positively related with instructional climate, child-centered climate and teacher's positivity in the classroom (Phillips et al., 2000, Pianta et al., 2002).

Researchers place a substantial emphasis on the quality gap among schools, especially between private and public ECE programs. In the literature, many research studies assessed the inequality in the quality of ECE programs and compared high- and low-quality schools (Britto & Limlingan, 2012; Burchinal et al., 2010). They assessed the quality of early childhood education in schools in terms of educational activities, the physical environment, and the social-emotional climate. They found that the higher quality of an early childhood education classroom is positively related to children's language, reading, and math skills. Results also showed that children from low-income families are more likely to attend lower-quality early childhood education centers (Burchinal et al., 2010; Pianta et al., 2002; Stipek et al., 1998; Tremblay et al., 2001). According to Britto and Limlingan (2012), inequality between children in terms of accessing higher quality early childhood education programs may make the school readiness and achievement gap wider. Since the quality of class instruction predicts children's academic achievement and social-emotional development, researchers suggested that states and countries should make an effort to provide high-quality early childhood education for low-income children to contribute to their whole developmental outcomes (Burchinal et al., 2010).

When it comes to the quality of early childhood education in Turkey, researchers emphasize that overall levels of quality in early childhood institutions in Turkey are low and there are significant gaps between schools that are high and low quality (Derman & Başal, 2010). According to the statistics for the year 2020, a great part of the budget in early childhood education institutions is spent on personnel expenses. The proportion given from the national budget for education is too small and not enough to meet the needs of the schools and the children (MoNE, 2013). In addition to problems that are associated with the budget early childhood education receives, Kıldan (2010) stated that Turkey fell behind all the European Countries in terms of attendance rates of children in early childhood education. Researchers and educational specialists suggest that while making center-based early childhood education classrooms expand, setting comprehensive and sustainable high-quality standards is very crucial (AÇEV & ERG, 2016; Derman & Başal, 2010; Kıldan, 2010). Unfortunately, Turkey does not achieve high-quality ECE because of inadequacy in the number of teachers, and inappropriate physical settings for early childhood education classrooms (Derman & Başal, 2010; Kıldan, 2010). Overcrowded classrooms, inappropriate locations of

schools, inadequate learning materials, less educated teachers, and higher child-teacher ratios are indicators of low-quality ECE programs (Britto & Limlingan, 2012).

Objectives and Research Questions

Providing early public childhood education services is very important for the accessibility of those services for children and families (AÇEV & ERG, 2013; Laosa, 2005). Despite early childhood education not being mandatory including kindergarten education, over half the children in Turkey attend publicly funded early childhood education programs that are located either within an elementary school setting or an independent preschool (MoNE, 2013). Since more children have access to publicly funded early childhood education, it is crucial to conduct research assessing the quality of these schools which is a significant factor contributing to children's holistic development outcomes (Mashburn et al., 2008; Pianta et al., 2002).

Previous research has shown that there are significant correlations between the socio-economic status of families (educational status, occupational status, age of marriage, number of children in the home, marital status, monthly income), developmental outcomes of children, and educational opportunities that children can access (Coley, 2002; Erkan, 2011). Therefore, the current study aims to get comprehensive data on how children's socio-economic background is associated with the quality features of public ECE classrooms in terms of teachers' occupational experience and physical and pedagogical quality features. The research questions are asking: "Is there a relationship between children's socio-economic background and the quality of ECE classrooms" and "Does the quality of early childhood education differ based on the socio-economic background of children?".

Method

This study is correlational research attempting to assess the relationship between the different variables. The data is collected in two districts of the metropolitan area of İstanbul, Turkey. These districts are Beşiktaş and Kağıthane and located on the European side of the city of İstanbul and thought to represent diverse backgrounds of families. Although the non-random purposive sampling method is used to select these districts of İstanbul (Büyüköztürk et al., 2017; Creswell, 2009), these districts are large, growing continuously, and have a more heterogeneous population of families in terms of socio-economic background and neighborhood characteristics. These districts constitute neighborhoods that are both high and low socio-economically and have the potential to provide rich data for this study (İstanbul Rehberi, 2015).

After obtaining consent from the parents, school administrators, and the teachers to participate in the study, demographic information sheets were distributed to parents to be returned to their classroom teachers in a sealed envelope. Two hundred seventeen parents gave permission to participate in the research, filled out the demographic information sheets, and returned those forms to classroom teachers in

sealed envelopes. Additionally, in order to assess the quality of early childhood programs the children of these parents were attending, 8 public primary education schools were visited and observed. These observations allowed for the assessment of the quality of the ECE environment and demographic information data that were collected from 22 early childhood education classrooms provided background information about the teachers. Of the six schools that had half-day programs, the observation took two school days in each of the classrooms constituting a total of ten hours per classroom. In the remaining two schools that had full-day programs, observation in each classroom was completed again in two days, taking sixteen hours. To protect the confidentiality and anonymity of the participants and the participating schools, names of the schools, teachers, parents, and children were not used; codes were given by the researcher for each child, teacher, and school.

Participants

In the current study, there were 217 preschool children who attend public preschool programs for 48-66 months old children. Of these children, 107 of them were female while 110 of them were male children. Additionally, children's parents (both mothers and fathers) filled out demographic information forms to collect data on the background of the participating children.

After receiving approval from The Primary Education Department of the Educational Faculty of Boğaziçi University and the Ethics Committee of the Institute for Graduate Studies in Social Sciences (file no: SBB-EAK 2016/15) for conducting research, the İstanbul City Administration Department of the Ministry of Education was contacted to get permission to collect data from preschool classrooms of public schools in the İstanbul metropolitan area. Then, 8 public schools that are located in the two districts of İstanbul (Beşiktaş and Kağıthane) were selected and visited.

Of those schools selected for the study, one of them was an independent ECE public school that is located in Beşiktaş and the children were attending this school for a full day (8 hours). Other schools were primary education public schools that had ECE classrooms. Two of them were located in Beşiktaş, but the others were located in Kağıthane. The duration of a school day had two types: half-day program and full-day program (See Tables 1 and 2).

Table 1

Percentage Distribution of the Duration of a School Day

Type of the school program	*N*	Percent
half-day program (5 hours)	6	75 %
full-day program (8 hours)	2	25 %
Total	8	100 %

Table 2

Percentage Distribution of Children's Attendance to the Different School Programs

Type of the school program	*N*	Percent
half-day program (5 hours)	176	81.1 %
full-day program (8 hours)	41	18.9 %
Total	217	100 %

Examination of the demographic information of 22 ECE teachers, who were all female, revealed that all the teachers had undergraduate degrees in Early Childhood Education (See Table 3).

Table 3

Percentage Distribution of the Participant Teachers' Graduation Schools

Type of the graduation school	*N*	Percent
Distance education faculty	1	4.5%
Four-year university	19	86.4 %
Master's degree	2	9.1 %
Total	22	100 %

Instruments

The demographic information form for parents included questions about parents' monthly income, their educational status, their occupational status, the number of children that they have, their marital status, languages that they know, and their age.

Also, this form included questions about the age and gender of children, children's attendance duration to formal early childhood education, and languages that children know. Similarly, the demographic information form for early childhood education classroom teachers included questions about teachers' age, gender, and educational and occupational backgrounds.

The quality of ECE classrooms was assessed with the "Environment Rating Scale Self-Assessment Readiness Checklist" by the researcher via non-participant classroom observations (Center for Early Childhood Professional Development, 2003). The researcher visited the schools, and she did non-participant classroom observations to complete the classroom quality checklist. The quality checklist included information about the name and location of the school, class size, and age group of class. The quality checklist had 7 sub-scales: space and furnishings, personal care routines, language and reasoning, activities, interactions, program structure, and parents and staff. Center for Early Childhood Professional Development (2003) constructed this checklist by reviewing the "Early Childhood Environment Rating Scale (Harms et al., 1998)", "Infant-Toddler Environment Rating Scale (Harms et al., 2003)", and "School-Age Care Environment Rating Scale (Harms et al., 1996)".

The quality checklist consisted of 4-Point-Likert type items: 0 for "Not Apply", 1 for "Not Met", 2 for "Partially Met", and 3 for "Fully Met". The internal reliability scores of the checklist were computed with Cronbach's Alpha. The reliability score of the checklist was .952. Also, the internal reliability scores of the checklist's sub-scales were calculated (See Table 4).

Table 4

Internal Reliability Scores of the "Environment Rating Scale Self-Assessment Readiness Checklist"

Sub-scales of the checklist	N of items	Cronbach's Alpha
Space and furnishings	12	.845
Personal care routines	17	.725
Language and reasoning	8	.882
Activities	10	.819
Interactions	5	.898
Program structure	5	.238
Parents and staff	12	.765

Results

There were 107 female children whose mean age (monthly) was 64.5 months (*SD* = 5.546), and 110 male children whose mean age (monthly) was 64.68 months (*SD* = 4.793). Children's age (monthly) ranged from 47 to 76 months; female children's age (monthly) ranged from 49 to 76 months, and male children's age (monthly) ranged from 47 to 73 months. Fifty-four-point eight percent of these children had been attending a formal early childhood education classroom for one year, 25.8% of them for two years, 16.1% of them for three years, and 3.2% of them for four years.

Examination of the employment status of the parents revealed that almost forty percent of mothers were working and 59.4% of them were not working. Ninety-two percent of fathers were working, 5.5% of them were not working, and 1.8% of them were retired. The educational status of the parents is presented in Tables 5 and 6.

Table 5

Educational Status of the Mothers

Educational status	N	Percent
Primary education	73	33.6 %
High school	67	30.9 %
Bachelor's degree	68	31.3 %
Master's degree	7	3.2 %

Table 6

Educational Status of the Fathers

Educational status	N	Percent
Primary education	76	35 %
High school	64	29.5 %
Bachelor's degree	61	28.1 %
Master's degree	10	4.6 %
Doctoral degree	2	9 %

The number of children that parents had ranged from 1 to 6 (See Table 7) with the majority of them having 2 children. Also, parents rated their socio-economic status by selecting their total monthly income (See Table 8).

Table 7

Percentage Distribution of Number of Children that Parents Had

Number of children	N	Percentage
1	67	30.9 %
2	116	53.5 %
3	26	12 %
4	6	2.8 %
5	1	5 %
6	1	5 %
Total	217	100 %

Table 8

Percentage Distribution of Parents' Total Monthly Income

	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 800 TL	3	1.4	1.4	1.4
801-1300 TL	28	12.9	12.9	14.3
1301-1800 TL	31	14.3	14.3	28.6
1801-2300 TL	33	15.2	15.2	43.8
2301-2800 TL	23	10.6	10.6	54.4
2801-3300 TL	24	11.1	11.1	65.4
3301-3800 TL	13	6.0	6.0	71.4
3801-4300 TL	5	2.3	2.3	73.7
4301-4800 TL	9	4.1	4.1	77.9
4801-5300 TL	18	8.3	8.3	86.2
5301-5800 TL	5	2.3	2.3	88.5
5801-6300 TL	5	2.3	2.3	90.8
6301-6800 TL	5	2.3	2.3	93.1
6801-7300 TL	4	1.8	1.8	94.9
7301-7800 TL	2	.9	.9	95.9
7801-8300 TL	1	.5	.5	96.3
8301-8800 TL	2	.9	.9	97.2
8801-9300 TL	1	.5	.5	97.7
9300 TL and higher	5	2.3	2.3	100
Total	217	100	100	

The average age of the early childhood education classroom teachers was 33 (M = 33.18, SD = 6.745) with ages ranging from 25 to 54. Those teachers' mean length of experience in teaching occupation was 9.95 years (SD = 5.964) and it ranged from 3 to 25 years.

The mean class size of all 22 early childhood education classrooms was 19.55 (SD = 2.988) and their class sizes ranged from 13 to 25. All of the twenty-two classrooms provided education for children whose age was between 48 and 66 months. Sixty-eight-point two percent of classrooms had a half-day program (5 hours), and 31.8% of them had a full-day program (8 hours). Total quality scores of the early childhood education classrooms from the "Environment Rating Scale Self-Assessment Readiness Checklist" were ranged from 103 to 162 points. The points of different sub-scales of the "Environment Rating Scale Self-Assessment Readiness Checklist" were also calculated (See Table 9).

The research question of the current study was asking whether there was a relationship between children's socioeconomic background and the quality of early childhood education classrooms. Results of the study showed that there was a significant positive relationship between the educational level of children's mothers and total quality scores of the early childhood education classrooms from "Environment Rating Scale Self-Assessment Readiness Checklist", r = .454, p = .000. Also, there was a significant positive relationship between the educational status of the fathers and the total quality scores of the classrooms, r = .420, p = .000. These results indicated that children whose parents had higher educational status were more likely to attend higher-quality early childhood education classrooms (See Tables 10 and 11).

Based on the results of the data analyses, the total monthly incomes of children's families were significantly and positively correlated with the total quality scores of the early childhood education classrooms, r = .391, p = .000. Children whose parents had higher monthly income were more likely to attend early childhood education classrooms, which got higher educational quality. Furthermore, the relationships between the number of siblings that children had and the total quality scores of the classrooms were analyzed. The results of the analyses showed that there was a significant negative correlation between those two variables, r = -.232, p = .001. This result indicated that children who had more siblings were more likely to attend early childhood education classrooms that got lower quality scores (See Tables 10 and 11).

Within the scope of the current study, the relationships between children's socioeconomic background variables including total monthly income of the families, number of siblings that children have, educational status of mothers, and educational levels of fathers, and different parts of the "Environment Rating Scale Self-Assessment Readiness Checklist" including "Space and Furnishings", "Personal Care Routines", "Language and Reasoning", "Activities", "Interactions", "Parents and Staff" and "Program Structure" were calculated. The results illustrated that even if the schools are public, children who had better socioeconomic backgrounds were more likely to attend higher-quality early childhood education classrooms in terms of various quality standards (See Tables 10 and 11).

Table 9

Quality Scores of the Early Childhood Education Classrooms (N=22)

Code of the School	Code of the Teacher	Space and Furnishings	Personal Care Routines	Language and Reasoning	Activities	Interactions	Parents and Staff Relations	Program Structure	Total Quality Score of ECE Classroom
1	1.1	21	30	20	18	15	10	21	135
1	1.2	17	26	14	13	10	7	19	106
2	2.1	19	30	11	16	8	7	19	110
2	2.2	22	30	16	16	10	8	20	122
2	2.3	20	29	12	17	6	7	19	110
3	3.1	29	39	24	24	15	11	20	162
4	4.1	17	29	10	17	8	7	16	104
4	4.2	15	30	15	16	11	7	16	110
4	4.3	17	29	12	16	7	6	16	103
5	5.1	21	31	13	15	14	7	18	119
5	5.2	20	31	16	16	11	8	18	120
6	6.1	25	32	21	18	15	9	21	141
6	6.2	21	32	17	17	13	8	21	129
7	7.1	32	34	18	23	14	11	26	158
7	7.2	29	32	13	18	8	9	25	134
7	7.3	32	35	17	23	10	9	26	152
7	7.4	29	33	18	19	13	9	26	147
8	8.1	21	31	13	17	10	8	16	116
8	8.2	19	30	14	17	10	6	18	114
8	8.3	20	30	15	17	10	6	18	116
8	8.4	21	31	15	17	10	6	17	117
8	8.5	19	30	13	17	7	6	18	110

Table 10

Correlations between Children's Socioeconomic Background and Quality of the Classrooms

		1	2	3	4	5	6	7	8
		Space and Furnishings	Personal Care Routines	Language and Reasoning	Activities	Educational Status of Mother	Educational Status of Father	Number of Siblings	Total Monthly Income Families
1	Pearson Correlation								
	Sig. (2-tailed)								
2	Pearson Correlation	.807(**)							
	Sig. (2-tailed)	.000							
3	Pearson Correlation	.626(**)	.778(**)						
	Sig. (2-tailed)	.000	.000						
4	Pearson Correlation	.840(**)	.910(**)	.725(**)					
	Sig. (2-tailed)	.000	.000	.000					
5	Pearson Correlation	.507(**)	.315(**)	.302(**)	.349(**)				
	Sig. (2-tailed)	.000	.000	.000	.000				
6	Pearson Correlation	.473(**)	.301(**)	.238(**)	.337(**)	.660(**)			
	Sig. (2-tailed)	.000	.000	.000	.000	.000			
7	Pearson Correlation	-.240(**)	-.193(**)	-.194(**)	.176(**)	-.303(**)	-.162(*)		
	Sig. (2-tailed)	.000	.004	.004	.010	.000	.018		
8	Pearson Correlation	.435(**)	.214(**)	.231(**)	.285(**)	.553(**)	.543(**)	-.158(*)	
	Sig. (2-tailed)	.000	.002	.001	.000	.000	.000	.020	

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

Table 11

Correlations between Children's Socioeconomic Background and Quality of the Classrooms

		1	2	3	4	5	6	7	8
		Interactions	Parents and Staff Relations	Program Structure	Total Quality Score of ECE Classroom	Educational Status of Mother	Educational Status of Father	Number of Siblings	Total Monthly Income Families
1	Pearson Correlation								
	Sig. (2-tailed)								
2	Pearson Correlation	.356(**)							
	Sig. (2-tailed)	.000							
3	Pearson Correlation	.720(**)	.643(**)						
	Sig. (2-tailed)	.000	.000						
4	Pearson Correlation	.727(**)	.745(**)	.903(**)					
	Sig. (2-tailed)	.000	.000	.000					
5	Pearson Correlation	.257(**)	.515(**)	.366(**)	.454(**)				
	Sig. (2-tailed)	.000	.000	.000	.000				
6	Pearson Correlation	.256(**)	.479(**)	.341(**)	.420(**)	.660(**)			
	Sig. (2-tailed)	.000	.000	.000	.000	.000			
7	Pearson Correlation	-.164(*)	-.206(**)	-.160(*)	-.232(**)	-.303(**)	-.162(*)		
	Sig. (2-tailed)	.016	.002	.019	.001	.000	.018		
8	Pearson Correlation	.249(**)	.496(**)	.368(**)	.391(**)	.553(**)	.543(**)	-.158(*)	
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.020	

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

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

Discussion, Conclusions, and Future Directions

Children's adaptation to school and success have long been serious concerns for parents and the states alike (Karoly et al., 2006). Parents want to see their children succeed and thrive, and also want to make sure that the schools support children's efforts and prepare them for success. Similarly, states want to have successful citizens who contribute to the welfare of their states in the future. In this regard, Heckman (2006) suggested that for individuals to carry on personally fulfilling and successful lives and benefit the states and the community is all related to investing in children's early childhood years. Moreover, investment in the early years would allow for the disadvantaged children who lack support in their homes for optimal development to receive cognitive and emotional support and compensatory care during early childhood education (Karoly et al., 2006). Thus, providing high-quality and mandatory early childhood education for children and their families is one of the first and crucial steps to invest in the early years that will help children to develop to their fullest and disadvantaged children close the gaps before primary school begins (Heckman, 2011). In fact, there is vast literature suggesting that there exists a positive relationship between children's development and their later success (Romano et al., 2010; Pianta et al., 2002).

Within the scope of the current study, the data about the quality of ECE classrooms were collected to assess the relationship between children's socioeconomic backgrounds and the quality of ECE schools. Different dimensions of the ECE schools' quality were investigated based on the literature suggested: space and furnishings, personal care routines, language and reasoning, activities, interactions, program structure, and parents and staff (Britto & Limlingan, 2012; Kıldan, 2010). Results of the current study indicated that all quality dimensions were significantly correlated with the socio-economic background of children like parents' educational status, monthly income, and the number of children that parents have. There is a vast amount of research asserting that difference between schools in terms of the quality leads to an achievement gap among children (Britto & Limlingan, 2012; Burchinal et al., 2010; Pagani et al., 2010). Moreover, considering that children's disadvantage starts at birth as the socioeconomic status of the families determines the resources provided at home, the quality of early childhood education becomes crucial to compensate for what families cannot provide at home (Heckman, 2011; Karoly et al., 2006). In fact, evidence suggests that high-quality early childhood education can allow for prior disadvantages to subside and allow children to catch up and give them a chance to have an equal start for later school years (Felfe & Lalive, 2018). Conversely, low-quality early childhood education could be a risk factor on its own for later academic achievement. Thus, it is essential for children, coming from all socioeconomic backgrounds to have access to high-quality early childhood education. Within this regard, however, the results of the current research showed that children who come from higher socioeconomic status environments were more likely to attend early childhood education schools which have higher quality in terms of space and furnishing, personal care routines, language, and reasoning, activities, interactions, parents and staff relations, and program structure. Specifically, children whose parents have higher educational status and higher total monthly incomes were more likely to attend higher-quality schools. Unfortunately, this

finding suggests that the disadvantaged children do not get a chance to have opportunities to catch up during early childhood education, and those with parents who have higher income and higher education attend schools having higher quality. Findings of the current research seem to coincide with the related literature suggesting that the income level of parents and their educational status are positively related to the quality of early childhood education schools children attend (Burchinal et al., 2010; Fryer & Levitt, 2004; Göl-Güven, 2018; Karlıdağ-Dennis et al., 2022, Pianta et al., 2002).

The findings of the current study also suggested that the number of siblings children had was inversely related to the quality of early childhood education children received. A similar finding was reported by Coley (2002) and Erkan (2011) that when the number of children parents have is higher, access to education and rich educational opportunities may not be easily available for children, and this as a result could have a negative impact on the developmental outcomes of children. It is reasonable to argue that as the number of children increases at home, the power of income to sustain a quality life decreases, and even the most involved parents are left with dividing their attention between more children, leaving each child with relatively less. Boonk, Gijselaers, Ritzen, and Brand-Gruwel (2018) reported that parental involvement, measured by reading, having high expectations from children to do well academically, and having dialogues with children regarding schooling, as well as encouragement and support for learning are all associated with academic achievement. Such involvement indicators definitely require more time and greater effort from parents when the number of children is high and dividing them over children may leave each child with insufficient involvement from their parents.

Early childhood education in Turkey is not mandatory and receives very little financial support and resources from the state, even if early childhood classrooms are located within state schools (Saklan & Erginer, 2016). Thus, providing high-quality early childhood education requires teachers and their principals to be dedicated and to place greater individual effort. This means that even if the curriculum used is the same across the nation in all state schools, implementation is far from being standard, relying on teachers' dedication and skills. As a result, how early childhood education is practiced at each school, and even in each classroom varies and teachers become key variables determining the quality of early childhood education. In a study, Önder and Güçlü (2014) conducted interviews with representatives of major non-governmental organizations that provide work in the field of education and educational unions asking for their opinions on how to improve the quality of early childhood education in Turkey. Their findings revealed that currently in Turkey, teachers are the key actors determining whether there is high-quality early childhood education and there is a vast amount of discrepancy in quality across the nation. They argue that even in the same school district the quality varies. This, of course, makes access to high-quality early childhood education highly competitive, and families of low income and parental education are at a greater disadvantage. As Li and Qiu (2018) also argue, where there is competition among parents to access quality education, those with better resources will have a greater advantage than those families who are already disadvantaged. Disappointingly, in the end, what we end up seeing is that early childhood education institutions that are

supposed to allow for disadvantaged children with resources so that these children can catch up and have equal start become mills that reproduce and amplify inequalities. The evidence from the present research supports the notion that families with better backgrounds and resources are the ones that also have access to hşgher quality education. It is possible that not only do these families seek and have access to higher quality early childhood education, but also they contribute to the quality of their children's schools by having higher expectations and demands from the schools as well as by being involved and providing support. The present research is limited in providing insight into understanding the mechanisms in which parents with higher income and education will have children who attend higher quality early childhood education while children of low income and education parents end up receiving low-quality early childhood education. Thus, it is thus crucial future research explores factors associated with how parental income and education are associated with the quality of early childhood education. Do these parents simply find better schools, or is it that the dynamics of the interactions between these schools and the parents contribute to the quality?

The quality of ECE is a multidimensional concept. Therefore, assessing the quality of ECE classrooms comprehensively using multiple assessment techniques and multiple observers when observations are employed has crucial importance. Although the observations were conducted spending sufficient periods of time and using a structured checklist, there was yet only one researcher conducting observations within somewhat of a limited period of time. Thus, future researchers should consider having visits to ECE classrooms at different times over at least one school semester. This way observations conducted earlier in the semester when children first start school and later could provide evidence for whether quality indicators change in time. Furthermore, although using a checklist allowed for the observation to be more structured, participant observations and researchers spending a longer period of time could allow for teacher-child interactions to be observed and understood more in-depth. To reach more accurate assessments of the quality of early childhood education classrooms, future research processes may have different observers for classrooms, and they may observe classrooms on several occasions for the duration of a school year. Therefore, more comprehensive and reliable data in terms of the quality of the educational environment can be obtained. Another issue concerning data collection of the current study is that the sample was not randomly selected. Schools, teachers, and parents of children were selected from different districts of İstanbul city purposefully based on the accessibility. Although the schools were selected to be more representative in terms of demographics and the neighborhoods were more diverse, large, and highly populated (İstanbul Rehberi, 2015), we don't know whether the selection criteria allowed for a representative sample. It would be beneficial for future research to employ random selection and results can be generalized (Büyüköztürk et al., 2017; Creswell, 2009).

For the current study, only public schools were selected because the majority of the population attend public schools (MoNE, 2013). However, there are also private schools that provide early childhood education in Turkey. Studying both public and private early childhood education schools may give a better perspective on the status of

educational quality. Also, gathering data from both public and private schools will allow for comparisons such as resources, teacher preparation, motivation, and parent-teacher interaction. Considering that private schools would have parents with higher income and education, it would be beneficial to compare the quality of various classrooms that are private and state to explore how parental income and education manifest their effects on quality. Furthermore, exploring parental goals and involvement both in public and private schools could shed light on parent-related factors that contribute to the quality of early childhood education.

In summary, despite the limitations, the findings of the current research provide meaningful and significant insights into the state of ECE in Turkey. The current research is one of the few studies in Turkey with a more comprehensive view of the quality of public ECE schools and the socioeconomic background of parents. Similar to a report by AÇEV published in 2009, the findings of the current study indicated that the socio-economic background of children is strongly associated with the quality of ECE. Therefore, public services should be aware of the results to provide more equal and high-quality educational opportunities for the whole population. The National Ministry of Education should expand public early childhood education services, invest more in improving their quality, and easily accessible to all parents. High-quality educational environments in terms of physical equipment, learning activities, and social-emotional climate (AÇEV & ERG, 2016) should not be a privilege, but a common resource used by the state to give all children chances to have an equal start in elementary school. The findings of this study are important to improve the quality of educational services in Turkey because it leads to more questions and areas of research to explore where the current educational system has deficits and potential to improve.

Authors' Note

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Erken Çocukluk Eğitiminin Kalitesi ile Çocukların Sosyoekonomik Özellikleri Arasındaki İlişki

Öz

Erken çocukluk eğitimi (EÇE) okullarının ve sınıflarının kalitesi birçok araştırmacı tarafından incelenmiştir. Bu araştırmaların sonuçları, EÇE okulları ve sınıfları arasında büyük bir kalite farkı olduğunu göstermektedir. Yüksek kaliteli EÇE'ne erişme ve devam etme konusunda farklı sosyoekonomik geçmişlerden gelen çocuklar arasında eşitsizlik vardır. Çocuk nüfusun büyük bir bölümünün halihazırda kamuya bağlı EÇE okullarına devam ettiği bilinmektedir. Bu nedenle, mevcut çalışma, kamuya açık EÇE sınıflarının kalitesi hakkında kapsamlı veriler ve çocukların sosyoekonomik geçmişleri hakkında tanımlayıcı veriler elde etmeyi amaçlamaktadır. Buna dayanarak, mevcut çalışma, bu iki faktör arasında bir ilişki olup olmadığını ve çocuklar arasında yüksek kaliteli EÇE'ne erişme konusunda bir fark olup olmadığını değerlendirmeyi amaçlamaktadır. Bu çalışma ilişkisel bir araştırmadır. Verilerin toplanmasında tesadüfi olmayan amaçlı örnekleme yöntemi kullanılmıştır. Sonuçlar, ebeveynlerin sosyoekonomik faktörleri ile EÇE sınıflarının kalitesi arasında anlamlı bir pozitif ilişki olduğunu göstermektedir. Çalışma, çocuklar, ebeveynler, öğretmenler ve EÇE sınıflarının kalitesi ile ilgili faktörleri belirleyerek EÇE literatürüne katkıda bulunmuştur. Türkiye'de EÇE'nin kalitesini çok boyutlu bir bakış açısıyla tanımlayan ve araştıran ve özellikle aileleri, okulları, eğitim programlarını ve kültürü içeren daha fazla araştırmaya ihtiyaç vardır.

Anahtar Kelimeler: Erken çocukluk eğitimi, eğitimde kalite, küçük çocuklar

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An Examination of the Sixth Graders' Learning Styles and Conceptual Understanding of Integers

Bahar Dinçer

Abstract

In the present study, it was evaluated whether the learning styles of the students had an effect on their level of conceptual understanding of integers in mathematics and their views regarding the use of analogy. In the current "single-group pre- and post-test" design, the study group consisted of 52 sixth grade students. The learning style inventory, conceptual understanding test, and visual analogy supported mathematics teaching evaluation form were applied to the students. For quantitative data, the nonparametric Wilcoxon Signed Ranks Test, Kruskal Kruskal-Wallis H test and Mann Whitney U test analyses conducted while the qualitative data were evaluated using the content analysis technique. Statistically significant increase in students' conceptual understanding of integers was found when pre- and post-test scores compared. The post-test scores of visual students were statistically significantly higher than those of both the auditory and tactile/kinesthetic students. Another finding of the study indicated that the students expressed a positive opinion on visual analogy-supported mathematics teaching approach; however, there was no statistically significant difference in student' perspectives among their learning styles.

Keywords: Learning style, analogy in teaching mathematics, use of analogy

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Introduction

In teaching mathematics, providing education in accordance with the students' developmental levels is considered as highly significant. For this reason, it is vital to enhance conceptual development in a way that will facilitate the learning of the target audience (Baykul, 2005). In order for mathematics educators to make progress in these areas, the process by which students develop mathematical conceptions must be better understood.

In the process of reaching the target audience, learner-centered education has gained substantial importance. Considering individual differences is the basis of learner-centered education. Each student has a different learning style which significantly

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affects their learning performance. The concept of learning styles was first introduced by German researchers in the 1900s as a result of the interest in individual differences (Curry, 1983).

Related studies show that there are many different models related to learning styles. Hall and Moseley (2005) in a review study on learning styles between 1902 and 2002 found 71 different learning style models. It is argued that each researcher makes his own definition for three main reasons. The first reason is that each researcher is concerned with one of the dimensions of the learning process; the second reason is that they use different measurement tools, and the third reason is that there are very different theoretical foundations for learning styles (Cano et al., 2000). Therefore, many definitions have been made for the concept of learning styles. Some of these definitions are presented as follows: Learning style is related to the individual's preferences in acquiring behavioral changes (Ferrer, 1990). Learning style is the way an individual focus, process and remember a new and difficult information (Dunn & Dunn, 1992). Learning styles define individual differences in the learning process resulting from the individual's learning preferences (Kolb & Kolb, 2005). Davidson (1990) and DeBello (1990) defined learning styles as the way an individual acquires, processes and stores information. James and Gardner (1995) expressed learning styles as a complex behavior style and the conditions in which learners most efficiently and effectively perceive, process, store and remember what they aim to learn.

Based on the present state of knowledge, it can be said that knowing the learning styles of students will make it easier to determine appropriate strategies, methods and techniques for the instructional design and teaching environment. In addition, it can be predicted that designing an education program related to learning styles will contribute to the academic success of learners and will also help learners develop positive motivation and attitude towards learning.

Another concept closely related to learning styles is learning environment. Piaget (1952) states that in order to enable students to understand mathematical concepts, learning environments with different experiences are needed. These learning environments offer different learning styles. It also paves the way for the possibility of learners' benefiting from different methods, which in turn would contribute to the development of the learning process. One of these methods is the use of analogy. Analogies have been used since early history to teach concepts to children and adults. In addition to their function of comparing an object or situation with another situation, analogies offer rich, concrete mental contents that transfer an unfamiliar knowledge/situation to a familiar field (Harrison & Treagust, 1993). There are five features that characterize the use of analogies in teaching processes (Else et al., 2003). These are:

Table 1

The Features of Analogies in Teaching Processes

Near vs. far	Analogies with more similarities with the object are "near", and analogies with less similarity are "far".
Simple vs. complex	Comparisons in which only one or two items map to target are simple analogies, whereas analogies with more detailed relationships are complex analogies.
Familiar vs. unfamiliar	Analogies may differ depending on the familiarity of students.
Visual vs. functional	Functional analogies are used to express what the intended concept is, and visual analogies are used to state what it is like. Some analogies serve both purposes.
Position	Analogies can be presented at the beginning of a new topic or after other types of experiences.

Based on the definition and characteristics of the concept of analogy, it can be stated that they have a facilitating effect on learning processes by presenting familiar and concrete contents to students One of the issues that students have difficulty within the process of concretization in mathematics is the concept of integers and operations with integers (Hayes & Stacey, 1990). According to Linchevski and Williams (1999), expanding the concept of number is difficult for students who are new to this subject. While the natural number structure that previously existed in the minds of students is a facilitator in learning positive numbers, this process is difficult in the cases that involve negative numbers (Mc Corkle, 2001). Since the sub-learning domain of integers includes many abstract concepts, it is considered beneficial to teach this subject with possible events in daily life and support it by near, simple, familiar and visual analogies. With this view, in the planning phase of the teaching activity, it is of great importance to determine how the learning environment needs to be organized to help students achieve the expected goals and acquire the desired behaviors. It is suggested that the planning of a learning environment supported by visual materials will make teaching more effective and relevant. The use of different support tools as in the education process is also important in terms of providing permanent learning change. The more a designed teaching activity appeals to different sensory organs, the more effective and permanent the learning will be. Therefore, arranging stimuli in the learning environment to address more than one sensory organ is a priority in terms of multiple learning environments in order to create a lasting learning experience (Seferoğlu, 2006). For this reason, the analogies within the scope of the study are not only expressed verbally, but also transferred to the digital format by supporting them with visual elements so that they appeal to more senses.

It is necessary to examine effective learning not only in terms of learning environment but also in relation to individual differences. The literature on this subject

offers many frameworks. There are many authors who classify learning styles regarding individuals' perception preferences. The Barsch learning style model of which the present study was based on classifies learners according to how they take and internalize the information. Researchers based on the idea that individuals perceive all kinds of information with their sense organs categorize the learning styles as visual, auditory, tactile and kinesthetic, and they listed the characteristics of individuals according to their learning styles as follows. Visual learners work neatly and are disturbed by clutter, determine places for their belongings and try to keep them always in the same place. When visual materials are used, they learn more easily and remember what they learn by visualizing them. Visual learners are very good at speed reading, and they are sensitive to spelling, punctuation and other grammar rules in texts. Also, they use repetitions in their writing, which helps them with their learning process (Klavas, 1994). Auditory learners learn and remember more easily when they hear or listen. It is stated that these individuals start speaking quite early. They are sensitive to sound and music. In other words, they have improved speaking and listening skills. They prefer to learn by talking and discussing the subject. Group work is deemed appropriate as it provides the opportunity to speak and listen for these individuals. Since reading by eyes is not enough for them, they at least prefer to read in an audible voice. Due to the fact that they learn and remember easier through hearing rather than seeing, the narrative method is considered appropriate for auditory learners. It is also stated that auditory students are quite successful in learning foreign languages and in speaking local dialects (Barsch, 1996).

Many authors consider the kinesthetic and tactile learning styles together and state that these two learning styles cannot be separated from each other with clear lines as it is the case in visual and auditory features. Kinesthetic learners tend to move constantly, take on tasks such as cleaning the board in the classroom, closing the door, bringing chalk, opening the window. If they sit still for a long time, they move away from learning and show unwanted behaviors in the classroom. Therefore, these students can be unfairly described as naughty and lazy. Kinesthetic students cannot sufficiently benefit from visual and auditory tools in the learning environment. What they need is techniques that enable learning by doing and living. They learn more easily in the schoolyard, in laboratories or during excursions. Tactile students have also similar characteristics. They need to touch and feel objects related to learning material with their hands. The point where tactile students differ from kinesthetic students is that they learn more easily by using their hands and touching (Barsch, 1996).

The literature of learning style abounds with many studies that involve different learning style models prepared for different lessons. Özkan, Sungur, and Tekkaya (2004), for example, examined the effect of learning styles on students' success and found that there were significant differences in the biology achievements of students with different learning styles. In a study on secondary school students' learning styles and their success in social studies courses, it has been found that students' learning styles significantly affect their success in social studies courses (Bengiç, 2008). Dunn et al. (1990) investigated the effect of learning styles on student success and attitudes. Students were grouped based on their choice to learn alone, with their peers or

with no preferences. The results of the analysis showed that the preference for learning alone occurs mostly in the conditions of learning alone, and the preference for peer learning takes place more when it is possible for individuals to learn from each other. Students who do not have a choice of learning style did better in situations where learning conditions would allow them to work on their own rather than with peers. In addition, students with a cooperative learning style preference showed more positive attitudes than those who did not prefer a certain learning style. Matthews (1996) emphasized the relationship between high school students' learning styles and their academic achievement. Collinson (2000) found that there is a significant difference between students' academic success depending on their learning style preferences. Çakır et al. (2002) examined the effects of case-based learning, learning styles and gender on students' performance and high-level learning abilities, attitudes towards biology lesson and academic knowledge. Overall, it can be observed that the studies on learning styles are aimed at determining the learning styles of students at various grade levels, the effect of teaching based on students' learning style preference on their academic success, their attitudes towards the course and the permanence of the learned knowledge.

The effects of students' preferred learning styles on learning outcomes \ in mathematics and other courses have been addressed in some studies. Different from these studies, the effects of analogy-supported mathematics teaching were also examined in terms of learning styles in the present study. The current study was conducted particularly to find an answer to the following question: "Does the effect of visual analogy-supported teaching of the subject of integers on the sixth-grade students' level of conceptual understanding and their views on analogy use differ according to their learning styles?"

Concepts related to integers are among the basic concepts for mathematics lesson. In order to understand a concept, it is necessary to establish a relationship between the acquisition of basic knowledge and the components that make up that concept. In this process, teachers can make the conceptual learning process more effective by applying teaching methods appropriate to the different learning paths that students prefer. In this respect, the learning style students have may somehow affect the conceptual learning state and other cognitive and affective processes (Ferrer, 1990). Therefore, it would be beneficial to examine the variables, one of which may be learning styles, that affect students' performance in learning mathematics when visual analogy is used. When the related literature was examined, there was no national study to determine whether a relationship between students' learning styles and their performance existed in the analogy-supported teaching process. Based on this deficiency in the literature, the present study aims to examine the effect of visual analogy-supported mathematics teaching of the subject of "integers" on the sixth-grade students' conceptual understanding levels and whether this is mediated by students' learning styles. It also aims to examine whether students' views on analogy use varied depending on their learning styles. As a result, it is considered that this study will contribute to both national and international literature.

Sub-problems

The aim of this study is to determine the effects of visual analogy-supported teaching of integers on the sixth-grade students' conceptual understanding levels and their views on analogy-supported mathematics teaching and to evaluate them in terms of learning styles.

For this purpose, answers to the following research questions were sought:

1. Do the pre-test and post-test scores of the concept understanding test of the students participating in the study differ significantly?

2. Do the pre-test and post-test scores of the concept understanding test of the students participating in the study differ significantly according to their learning styles?

3. Do the results of the visual analogy-supported mathematics teaching assessment form of the students participating in the study differ significantly according to their learning styles?

Method

In this study, a "single group pre-test-post-test" model was used to determine whether the students benefited equally from the visual analogy supported learning method according to their learning styles. The model was applied to a randomly selected group by taking pre-test and post-test measurements (Karasar, 2005) and the results were used to examine whether the difference between two related sample means is significantly different from zero (each other). When the measurements of the same subjects regarding the dependent variable are taken before and after the experimental procedure, these measurements are related to each other (Büyüköztürk, 2006). In the study, the conceptual knowledge levels of the students were measured twice, once before and once after applying analogy-supported mathematics teaching.

Study Group

The study group consists of a total of 52 sixth grade students studying in two different classes of a secondary school in the western part of Turkey. Both classes took part in the research as the study group. The necessary official permission was obtained before commencing the study.

Data Collection Tools

Barsch Learning Style Inventory

The Barsch Learning Style Inventory has been determined as an appropriate data collection tool in terms of its suitability to the student level and determining the learning

style. It consists of 24 Likert-type items to determine "visual, auditory and kinesthetic learning styles" (Tekaz, 2004). The learning style of the student was decided according to the highest score obtained from the items in each subsection of the inventory. The Barsch Learning Style Inventory is a valid measure of learning styles as it has also been used by many other researchers (Barsch, 1996; Beck, 2007; Doyran, 2000; Halsne & Gatta, 2002). In the current study, the Cronbach Alpha coefficient of this inventory was found to be 0.60. Its validity was assessed by two subject matter experts who took the view that the Barsch Learning Style Inventory (1996) had the simple language and format and that a great number of learners can digest it without any help. Eventually, they concluded that the inventory was valid because it possesses face validity and content validity.

Concept Understanding Test

Preferring open-ended questions allows students to answer freely without limiting their answers, while reducing the probability of random correct answers to the questions. For this reason, a "Concept Understanding Test" was prepared by the researcher using open-ended questions in order to determine the level of understanding the concepts of integers. The questions were prepared with the concepts of integers. (Negative integer, positive integer, absolute value concept, notion of addition, notion of subtraction, commutative property, associative property, identity element, inverse element). The students were asked to explain and exemplify these concepts. In order to assess its validity, the researcher had face to face consultation with the two subject matter experts. Taking face validity and content validity, into consideration, they agreed on its validity.

In the evaluation phase, the scoring criteria proposed by Abraham, Williamson and Westbrook (1994) were used after certain modifications. In the original version, there were five different categories: sound understanding, partial understanding, partial understanding with specific misconception, specific misconceptions, no understanding. However, the evaluation in the current study was made in four different categories as sound understanding, partial understanding, specific misconceptions, no understanding. partial understanding with Specific Misconception and Specific Misconceptions categories were evaluated as a single category within the scope of this study; because together with the expert opinion, it was presumed that for the concepts at the secondary school level it is appropriate to consider these titles together. Responses in the sound understanding, partial understanding, partial understanding with specific misconception, specific misconceptions, no understanding categories were scored with 3, 2, 1, 0 points, respectively. In the concept understanding test of integers with 10 questions, the highest score a student can get is 30. Below are the characteristics of the answers in each category.

Table 2

The Characteristics of the Answers

Sound Understanding:	Responses that included all components of the validated response.
Partial Understanding:	Responses that included at least one of the components of validated response, but not all the components.
Specific Misconceptions:	Responses that included illogical or incorrect information.
No Understanding:	Repeated the question; contained irrelevant information or an unclear response; left the response blank

Visual Analogy Supported Mathematics Teaching Evaluation Form

This assessment form is a five-point rating type scale specially prepared for this study. It consists of questions about students' impressions and self-evaluation of mathematics teaching supported by visual analogy. The questions are about students' self-evaluation of their learning and all of the questions are in the relevant table in the findings section. The pilot study was carried out within the scope of the thesis by Dinçer (2019), and the scale items were created through observing the students' reactions to analogies by the researcher. Later, within the scope of this study, the scale items were narrowed down and only the items for self-assessment were examined. This evaluation form was examined by two domain experts. They stated that the questions were appropriate for the level of the student and the purpose of measurement.

Data Analysis

The content analysis method was used to analyze the data obtained from the answers that students gave to ten mathematical concepts/operations in the Concept Understanding Test. The main purpose in content analysis was to reach the concepts and relationships that can explain the collected data. In content analysis, the data were analyzed in depth and themes were revealed (Yıldırım & Şimşek, 2011). In the study, the data obtained were compared in terms of similarity and differences as a result of the coding made by the two encoders and the percentage of reliability between the scores was calculated by using the formula (Reliability = consensus / consensus + dissidence) developed by Miles and Huberman (1994). The reliability among the raters was found to be 87% by comparing similarities and differences.

The normality distribution of the groups was evaluated with the Kolmogorov Smirnov test since the size of the groups was greater than 50 (Büyüköztürk, 2006).

Because the groups were not distributed normally, the nonparametric Wilcoxon Signed Ranks Test was used for the first sub-problem in which the Conceptual Understanding Test scores were included.

To answer the second sub-problem of the study, it was examined whether the pretest-posttest results of the conceptual understanding form scores differed according to learning styles. For this purpose, the Kruskal-Wallis H test was used in the analyses between the groups. The Mann Whitney U test was performed to determine which learning style caused the difference between the groups. In the third sub-problem of the study, it was examined whether the results of the visual analogy-supported mathematics teaching assessment form of the students differed according to their learning styles. For this purpose, the Kruskal-Wallis H test for analysis between groups was used. Frequency and percentage calculations were used to determine the number of students with specific styles and rates. The significance level of 0.05 was taken as the basis for analyzing and interpreting the results obtained in the study.

Procedure

The researcher created analogies in the digital environment by establishing daily life connections for integers in line with her interest and the training she received as well as guiding sources in the literature. The reason why analogies were transferred to digital media, not just verbally, was to attract students' attention visually. Because it is aimed here to reveal the learning differences between students with visual and auditory learning styles. Within the scope of this research, ten original analogy supported teaching materials were prepared. These contents were examined by two experts in terms of suitability for the level of the students and content, and content validity was ensured. Since the content and preparation steps of the analogies are the subject of a different study, only the learning style dimension was included in this study.

In the study group, the lessons were taught by the researcher for 16 lesson hours. The subject of integers was taught for approximately 3 weeks, 5 lesson hours per week. In the research, first the concept understanding test was applied as a pre-test, and then visual analogies for the integers were presented. Finally, examples related to the subject were solved, the Concept Understanding test was re-applied as a post-test and the visual analogy supported mathematics teaching evaluation form was administered.

The prepared analogies were presented to the students with a smart board. During the implementations, student behaviors were also observed by the researcher.

Results

To investigate the difference between the pre-test and post-test scores of the students' concept understanding test, descriptive analyses were run. The descriptive statistics about the students' concept understanding test scores are given in Table 3.

Table 3

Descriptive Statistics of the Concept Understanding Test

Test	*N*	*X*	*s*	Min	Max
Pre-test	52	0.90	2.30	0.00	6
Post- test	52	18.59	6.20	4.00	30

In Table 3, the pre-test mean score for the integers area of the concept understanding test of the students was 0.90, whereas the post-test mean score was 18.59.

The scores of the students from the concept understanding pre- and post-tests were analyzed with the Wilcoxon Signed Ranks Test. The results are given in the Table 4.

Table 4

Wilcoxon Signed-Rank Test Results for Comparing the Concept Understanding Pretest-Post-test Scores

Group	*N*	Mean Rank	Sum of Ranks	*Z*	*p*
Negative Ranks	1	2.00	2	-6.259	0.00
Positive Ranks	51	26.98	1376.00		
Ties	0				

As can be seen in Table 4, the Wilcoxon Signed Rank Test indicated a statistically significant difference between the pre-test and post-test scores of the students ($Z = -6.259$, $p < 0.05$). Considering the sum of ranks of difference scores, this difference was in favor of the positive ranks and post-test.

To investigate the pre-test and post-test scores of the students according to their learning styles, the Kruskal- Wallis H test was performed.

Table 5 shows the results of the Kruskal-Wallis H test, which was conducted to compare the pre-test results of the students according to their learning styles.

Table 5

Kruskal Wallis H Test Results of the Pre-Test Scores According To The Learning Styles

Learning Style	***N***	**Xorder**	***SD***	***χ2***	***p***
Visual	22	31.43	2	4.69	0.09
Auditory	19	22.11			
Kinesthetic	11	24.23			

As can be observed in Table 5, according to the results of the Kruskal Wallis-H test conducted to determine whether the mean rank of the pre-test scores differed significantly according to the learning styles, there was no significant difference between the mean ranks of the groups ($p > .05$).

In Table 6, after applying the visual analogy-supported teaching method, the Kruskal-Wallis H test was performed to determine whether there was a statistically significant difference in the Concept Understanding post-test scores according to the students' learning styles.

Table 6

Kruskal Wallis H Test Results of the Post-Test Scores According to The Learning Styles

Learning Style	***N***	**Xorder**	***SD***	**χ2**	***p***
Visual	22	40.57	2	33.32	0.00
Auditory	19	14.97			
Kinesthetic	11	18.27			

According to Table 6, a significant difference was determined between the post-test scores of the students according to their preferred learning styles ($\chi2 = 33{,}32$, $p < 0.05$). To determine which group benefited more from the instruction, the students' Concept Understanding post-test scores were compared in pairs using the Mann Whitney U test.

Table 7

Mann Whitney-U Test Results of the Post-Test Scores According to The Learning Styles

Learning Style	***N***	**Xorder**	**Σorder**	***U***	***P***
Visual	22	29.70	653.50	17.50	0.00 *
Auditory	19	10.92	207.50		
Visual	22	22.36	492.00	3.00	0.00 *
Kinesthetic	11	6.27	69.00		
Auditory	19	14.05	267.00	77.00	0.23
Kinesthetic	11	18.00	198.00		

As observed in Table 7, the "Mann Whitney-U test" was carried out to determine whether the scores of the Concept Understanding test differ significantly according to the learning styles; it was found out that the post-test scores of visual students were statistically significantly higher than those of both auditory and kinesthetic students.

The results of descriptive analyses conducted about the visual analogy supported mathematics teaching evaluation form of the students are given in Table 8.

Table 9 shows the results of the Kruskal-Wallis H test, which was conducted to compare the visual analogy-supported mathematics teaching assessment form scores of the students according to their learning styles.

As the result of the Kruskal Wallis H test shows, the scores of the visual analogy-supported mathematics teaching assessment form did not differ significantly according to the preferred learning styles of the students. ($\chi 2 = 3.18$, $p > 0.05$).

Table 8

Descriptive Statistics about the Visual Analogy Supported Mathematics Teaching Evaluation Form

Items	*N*	Min.	Max.	Mean	Std. Deviation
I think I understand this topic.	52	1.00	5.00	4.01	.93
I can solve problems on this issue.	52	1.00	5.00	3.86	.84
I can make a connection between this subject and daily life.	52	2.00	5.00	4.34	.68
If I learned this subject again, I would prefer to learn it with the same method.	52	2.00	5.00	4.23	.64
I think the lessons are fun with this method.	52	2.00	5.00	4.40	.66

Table 9

Kruskal Wallis H Test Results of the Visual Analogy-Supported Mathematics Teaching Assessment Form Scores According to the Learning Styles

Learning Style	*N*	Xorder	*SD*	$\chi 2$	*p*
Visual	22	25.77	2	3.18	0.204
Auditory	19	23.39			
Kinesthetic	11	33.32			

Conclusion

This study examined the effect of mathematics teaching supported by visual analogy for the sub-learning area of integers on the conceptual understanding levels of the sixth-grade students and their views on the use of analogy. The findings showed that there was a significant difference between the pre- and post-test scores in favor of the post-test for the conceptual understanding levels of the students.

While there was no significant difference between the pre-test scores of the students according to their preferred learning styles, a significant difference was found

between the post-test scores. In order to specify which groups benefited more from the instruction, the Concept Understanding post-test scores were compared according to the learning styles, and it was determined that the post-test scores of the visual students were significantly higher than those of both auditory and kinesthetic students. It was found that the difference between the post-test scores of the auditory and kinesthetic students was not statistically significant. In this study, it was predicted before the study that students with visual learning style would learn concepts at a higher level as visual analogy supported mathematics teaching was carried out. In this case, there was a similarity between the expected result and the result obtained in the study.

According to this result, since visual analogies are more suitable for transferring conceptual knowledge in mathematics in a contextual manner, mathematics teaching based on this approach increases conceptual learning in all students with audio-visual and kinesthetic learning styles, but it is more effective for students with visual learning style. Based on other studies, it is concluded that the use of analogy is beneficial in terms of conceptual learning, academic achievement, permanent learning and attitude levels both in mathematics and other lessons (Cowan & Cipriani, 2009; Paris & Glynn, 2004).

In the present study, teaching with visual analogies positively affected students' views on visual analogy-supported mathematics teaching as well as conceptual learning, but there was no significant difference in terms of learning styles. The students scored an average of four to five on the Likert-type assessment scale items, and the mean score of only one item (I can solve problems on this subject) was below four and was calculated as 3.86. The reason of this situation could lie in the fact that the "problem" expression in the item root can include many problems in a general spectrum with an uncertain degree of difficulty. From the researcher's point of view, it was observed that the students had a great desire before the presentation of the analogies. The researcher experienced the feeling of production after generating each analogy and thanks to the positive feedbacks from the students; a motivational effect was created for the analogy fictions.

Learning styles correspond to computing activities and are fixed and difficult to change because of biological origin. People often uses them without realizing it. Learning strategies, on the other hand, are various techniques that students employ during learning by taking these features into account. However, since different learning processes require the application of different learning strategies, learning strategies can be diversified or changed if necessary and chosen according to the situation and the purpose of the lesson. An individual can use various strategies provided that they are suitable for his learning style (Babadoğan, 1994). Akkoyunlu (1995) emphasizes that determining students' learning styles has a positive effect on teachers’ choice of methods and techniques to be used in their classes. Similarly, in the education process, teaching models, strategies, principles, and methods and learning styles are important factors that play a key role. Many studies in the literature reveal that using teaching methods suitable for students 'learning styles helps to increase students' academic success. In this respect, understanding the interaction between learning styles and various teaching

methods will help to understand the education-teaching process. It also contributes to the development of this process and enable a more effective teaching design (Kumar et al., 2004). In the present study, it was observed how a different teaching method had an effect on students' learning of integers and how this was mediated by different learning styles.

As it is known, knowing the learning style of students prepares the ground for the selection and use of functional and appropriate learning models, strategies, methods and techniques. This situation leads to the exhibition of various organizations and activities for students with different learning styles; it contributes to the improvement of the efficiency, quality and permanence of the education system (Karakuyu & Tortop, 2010). In the same vein, Akkoyunlu (1995) emphasizes that determining the learning styles of students has a positive effect on the choice of teaching methods and techniques to be used by teachers. Similarly, including the present study, several studies concretely reveal that students can learn in different ways, have different individual preferences in receiving and processing information, and that there is a positive relationship between learning styles and various variables, especially academic success (Arslan & Durukan, 2015; Ataseven & Oğuz, 2015; Aydemir et al., 2016; Çelik & Gündüz, 2016; Demir, 2008; Dikmen et al, 2018; Erden, 2017; Sidekli & Akdoğdu, 2018).

When the results of the present study and other studies are evaluated in general, it could be concluded that effective and appropriate lessons plans require taking into account, students' learning styles, the use of visual analogy-supported teaching as well as employing different methods and strategies. Since the level of concept knowledge about integers within the scope of the research increased, it can be suggested to use different teaching methods and techniques, especially analogies, in order to form conceptual knowledge in the basic subjects of mathematics. In addition, it may be suggested to organize seminars or in-service training courses in order to increase the knowledge and skills of teachers, who are in the position of implementing different learning approaches. Finally, as a limitation of the present study and as a suggestion for other researchers a larger sample size can be used to create more generalizable results in the future.

Authors' Note

This study was approved by İzmir Provincial Directorate of National Education (Date and ethical decision number: 28/02/2018- 12018877-604.01.02-E-4236245)

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Altıncı Sınıf Öğrencilerinin Öğrenme Stilleri ve Tam Sayıları Kavramsal Anlayışlarının İncelenmesi

Öz

Bu çalışmada öğrencilerin öğrenme stillerinin matematik dersindeki tamsayılar konusuna yönelik kavramsal anlama düzeylerine ve analoji kullanımına ilişkin görüşlerine etkisinin olup olmadığı değerlendirilmişti. Çalışma kapsamında, ön deneme modellerinden "tek grup ön test-son test" modeli kullanılmıştır. Çalışma grubu 6.sınıf düzeyindeki 52 öğrenciden oluşmaktadır. Uygulama sürecinde öğrencilere öğrenme stili envanteri, kavram anlama testi ve görsel analoji destekli matematik öğretimi değerlendirme formu uygulanmıştır. Nicel verilerin değerlendirilmesinde SPSS paket programı kullanılmış ve nitel veriler içerik analizi tekniği kullanılarak değerlendirilmiştir. Araştırma verilerine göre, öğrencilerin kavramları anlama testi puanları son test lehinedir, öğrencilerin öğrenme stillerine göre son test puanları arasında anlamlı bir fark bulunmuştur. Görsel öğrencilerin son test puanlarının hem işitsel hem de dokunsal/kinestetik öğrencilerden farklı olduğu ve istatistiksel olarak daha yüksek düzeyde olduğu belirlenmiştir. Araştırmanın bir diğer sonucu olarak öğrencilerin görsel analoji destekli matematik öğretimine yönelik olumlu görüş bildirdikleri; ancak görüşlerinin ve öğrenme stilleri arasında anlamlı bir fark olmadığı tespit edilmiştir.

Anahtar Kelimeler: Öğrenme stili, matematik eğitiminde analoji, analoji kullanımı

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