Gender Gap and Career Choices in STEM Education: Turkey Sample

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Abstract

This study aims to explore middle school students' attitudes towards STEM fields and their interest in STEM careers in terms of gender. Furthermore, this study examines the relationship between middle school students' attitudes towards STEM fields and their interest in STEM careers. Seven hundred and seventy four students from 10 cities located in 6 geographical regions of Turkey completed the STEM Attitude Scale and STEM Career Interest Survey. It was determined that middle school students' attitudes towards STEM were not statistically significant in terms of gender. In addition, it was found that students' interest in STEM careers differed in terms of gender. When the scores of attitudes towards engineering and technology fields and the interest in careers in these fields were compared in terms of gender, significant difference in favor of male students was found. Furthermore, a positive correlation between the middle school students' attitudes towards STEM fields and their interest towards STEM careers was determined. Results indicate that approximately 43% of the total variance of interest towards STEM careers stems from attitudes towards STEM fields. The results obtained from this study will give an insight into how to shape the aims and applications of the future STEM education programs.

Keywords: STEM Attitude, STEM Career Interest, Gender, Middle School Students

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INTRODUCTION

STEM education is an interdisciplinary approach involving learning and teaching in the fields of science, technology, engineering and mathematics (Gonzalez and Kuenzi, 2012). STEM education develops skills of students in problem solving, critical thinking and analytical thinking (Koyunlu Unlu, Dökme and Unlu, 2016) and aims to raise innovative individuals who have an interdisciplinary point of view while approaching problems (Bybee, 2013; Clark and Button, 2011). In addition, STEM education allows students to engage with real-life problems and use questioning, problem solving, collaboration, and practical activities to find solutions, by focusing on student-centered education (Soylu, 2016).

"In the 21st century, scientific and technological innovations have become increasingly important as we face the benefits and challenges of both globalization and a knowledge-based economy" (National Science Board, 2007, p. 2). In order to achieve this, it is necessary to be sure of the tendency towards careers in the STEM fields and to draw the attention to the STEM fields. "Over the past 10 years, growth in STEM jobs was three times faster than growth in non-STEM jobs." (Langdon, McKittrick, Beede, Khan and Doms, 2011, p. 1). Thus, in many countries' education policy in the 21st century developing learning and teaching STEM education is associated with scientific leadership for the world of the future and is seen as an economic factor (Kennedy and Odell, 2014; National Research Council, 2011). This ensures to be focused on both increasing the interest and attitudes of female and male students towards fields of science, technology, engineering and mathematics and careers concerning these fields (Wyss, Heulskamp and Siebert, 2012). There are also a low number of students and gender differences in STEM fields (Mutlu and Korkut-Owen, 2017). For instance, according to a research made by Turkish Industry and Business Association in 2014 which was on gender distribution in STEM graduates working in companies working in STEM fields, the rate of male was higher (male 64%, female 36%). In relevant studies it is stated that women constitute the minority in STEM fields both in Turkey and the world (e.g. Beede, Julian, Langdon, McKittrick, Khan and Doms, 2011; Craig, Verma, Stokes, Evans and Abrol, 2018; Dika and D'Amico, 2016; Ivie and Tesfaye, 2012; Korkut-Owen and Mutlu, 2016; LeGrand, 2013; Mutlu and Korkut-Owen, 2017; National Science Board, 2014; OECD, 2006; Smith, 2011).Thus, it is crucial to investigate the attitudes of male and female students towards STEM fields and their interests in STEM careers as of their early ages and carry out activities accordingly. Furthermore, it is thought that attitudes towards STEM fields can affect the interest in STEM careers (Wiebe, Unfried and Faber, 2018). Therefore, research questions were determined as follows:

1- How do middle school students' attitudes towards STEM fields change considering their gender?

2- How do middle school students' interests in STEM careers change considering their gender?

3- Are there any significant relationships between middle school students' attitudes towards STEM fields and their interest in STEM careers?

Literature Review and Theoretical Framework

Social-Cognitive Career Theory (SCCT) and Interest in STEM Careers

In the present study, social-cognitive career theory (SCCT; Lent, Brown and Hackett, 1994) guided the present study because SCCT offers a relevant theoretical view regarding the interest in and choice of STEM careers (Chachashvili-Bolotin, Milner-Bolotin and Lissitsa, 2016). So far, SCCT has been used in many STEM studies as a theoretical framework (e.g., Beier, Kim, Saterbak, Leautaud, Bishnoi and Gilberto, 2018; Chachashvili-Bolotin et al., 2016; Wiebe et al., 2018). SCCT is based on Bandura's social-cognitive theory (Bandura, 1986). SCCT argues that people's interests stem partly

from their self-efficacy (beliefs about personal abilities), outcome expectations (beliefs about the outcome of certain behaviors), social support, and learning experiences (Lent et al., 2005). Self-efficacy refers to a person's belief in his ability to complete tasks and to influence events affecting his life (Bandura, 1986). Moreover, self-efficacy is an important factor influencing students' interests in careers (Tang, Pan and Newmeyer, 2008). Scott and Mallinckrodt (2005) indicated that students' high self-efficacy in middle or high school science influences their choice of STEM fields at the university.

The scales utilized in the present study (STEM Attitude Scale and STEM Career Interest Survey) are closely related to individuals' self-efficacy beliefs regarding STEM fields and careers (Kier, Blanchard, Osborne and Albert, 2014; Unfried, Faber and Wiebe, 2014; Wiebe et al., 2018). Additionally, the STEM Career Interest Survey is based on the key features of SCCT (e.g., self-efficacy, outcome expectations, personal inputs, and contextual supports and barriers) (Kier et al., 2014). Therefore, SSCT framework guided selection of these two instruments for the purpose of addressing research interests of the present study. The schematized form of the SCCT is illustrated in Figure 1.

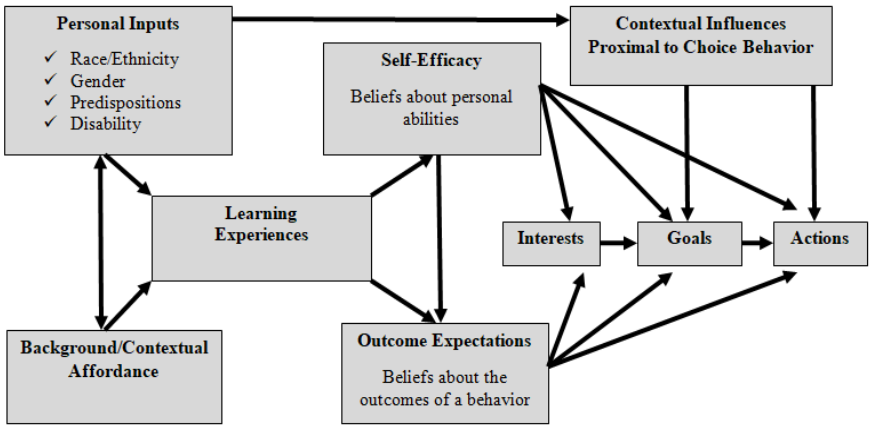

Figure 1. The social-cognitive career theory (Lent, Brown and Hackett, 2000)

STEM Education and Gender

Today, there are concerns that different groups are not adequately represented in STEM fields (Dika and D'Amico, 2016). In this context, gender inequality is a highlighted issue in STEM careers. Gender is an important factor shaping interest in STEM fields and attitudes towards STEM careers (Chachashvili-Bolotin et al., 2016; Wiebe et al., 2018). It is widely known that women are underrepresented in STEM-related careers and there is no gender equality in this respect (Ivie and Tesfaye, 2012; Craig et al., 2018; LeGrand, 2013; National Science Board, 2014; OECD, 2006; Smith, 2011) and that female students are less interested in STEM careers (Unfried et al., 2014). For example, according to the National Science Board (2014), women are represented at 23% in engineering, 25% in computer sciences, 33% in physical sciences, and 38% in economics, which are quite low. Bokova (2017) stated that women in higher education account for only 35% of all students enrolled in STEM-related study fields. The lack of representation of women in STEM fields is a problem for society, organizations, employers and individuals, which, above all, threatens the power of global competitiveness (Greenfield, Peters, Lane, Rees and Samuels, 2002). Underrepresentation of women in STEM fields may also cause social inequality. Therefore, it is necessary to emphasize this problem and finding solutions in studies (Fox, Sonnert and Nikiforova, 2011). In this respect, the present study examines whether gender is a significant factor on the attitude towards STEM fields and interest in STEM careers.

Attitude towards STEM Fields and Interest in STEM Careers

Being interested in something means that thing is important to us and we have (mostly) positive feelings towards it (Harackiewicz and Hulleman, 2010). Therefore, interest is one of the most important factors that influence a student's field of work choice (Vulperhorst, Wessels, Bakker and Akkerman, 2018). Recent research has focused on students' interest in STEM careers since STEM-related careers often offer higher financial returns, and STEM has an important role in supporting and sustaining economic prosperity (Riegle-Crumb, King, Grodsky and Muller, 2012).

Nowadays, there is a need for the labor force specializing in STEM careers for countries to achieve a sustainable development (Chachashvili-Bolotin et al., 2016; Wyss et al., 2012). The number of students studying in STEM fields is considered to be insufficient to meet the needs of the labor market (Craig et al., 2018; Vulperhorst et al., 2018). For this reason, studies are carried out to enhance students' interest in STEM careers. In 2011, the National Research Council called on K-12 educators to convince their students to pursue STEM careers. Moreover, an emphasis is also placed on designing STEM education programs to ensure that students develop positive attitudes towards STEM subjects and careers (Faber, Unfried, Wiebe, Corn, Townsend and Collins, 2013). Due to the importance of meeting the needs of the labor market, students need to be encouraged to work in careers in the STEM fields.

Attitude is a whole of beliefs about an object, event or subject and can be positive or negative (Crisp and Turner, 2007). One of the factors that affect students' interest in STEM careers is the attitude towards STEM fields (Wiebe et al., 2018). The attitude towards STEM fields is also related to self-efficacy in these fields (Unfried et al., 2014). Also, students' belief in self-efficacy in STEM fields affects their interest in STEM careers (Tang et al., 2008; Wiebe et al., 2018). For example, in their study, Scott and Mallinckrodt (2005) found that students' high self-efficacy in science influenced their choice of STEM fields at university. In studies conducted on the subject, it is stated that there is a relationship between attitude towards STEM and interest in STEM careers. For example, Unfried et al. (2014) found that female students had a negative attitude towards engineering and technology from STEM fields and their interest in STEM careers was low. In another study, Wiebe et al. (2018) found a relationship between attitude towards mathematics and interest in STEM careers. Aydın, Saka and Guzey (2017) also found that students with high level of attitude towards STEM prefer careers in STEM fields. This finding shows that there is a relation between the attitude towards STEM and interest in STEM careers.Therefore, it is necessary to give importance to helping students develop positive attitudes towards STEM fields in order to increase their interest in STEM careers.

Purpose and Rationale of Study

When the literature concerning to STEM education was examined, it was determined that the research which investigated attitude towards STEM fields (Karakaya and Avgın, 2016; Tseng, Chang, Lou and Chen, 2013) and interest in STEM careers (Wyss et al., 2012) were carried out separately. However, we have not found any research within the current literature investigating middle school students' attitudes towards STEM fields and their interests in STEM careers in terms of gender simultaneously and particularly in Turkey context. Moreover, in many studies, it is emphasized that interest towards STEM fields and STEM careers begins during middle school period or even before middle school period (Kier et al., 2014; Maltese and Tai, 2010; Tai, Liu, Maltese and Fan, 2006; Wyss et al., 2012). Therefore, it is important to investigate *middle school students'* interests and attitudes towards STEM fields and careers. Besides, related literature about STEM education includes studies on gender gap in STEM education both in Turkey and the world (Beede et al., 2011; Craig et al., 2018; Dika and D'Amico, 2016; Ivie and Tesfaye, 2012; Korkut-Owen and Mutlu, 2016; LeGrand, 2013; Mutlu and Korkut-Owen, 2017; National Science Board, 2014; OECD, 2006; Smith, 2011), and projects such as Girls In STEM (GIS), Girls Can STEM, to encourage female inclusion to STEM fields and careers in Turkey. In this regard, investigation of whether gender effect is a major factor in students' attitudes towards STEM fields and their interest in STEM related careers is a crucial point of

interest in the current STEM education agenda. In addition, the number of studies (e.g., Wiebe et al., 2018), which focus on the relationship between attitude towards STEM and interest in STEM careers, is insufficient in the current literature. For this reason, the aim of present study is to investigate the attitudes of 5th, 6th, 7th and 8th grade students' towards STEM fields, and their interests in STEM careers in terms of gender variable. Furthermore, investigation of the relationship between middle school students' attitudes towards STEM fields and their interests towards STEM careers is another purpose of the study. In line with the aims of the present study, SCCT which provides a relevant theoretical view on the interest in STEM career choice (Chachashvili-Bolotin et al., 2016) was employed in the present study.

In the 21st century, STEM education and STEM related careers get more important importance day by day, leading educational policies of governments in accordance with its needs. Therefore, determination of Turkish students' attitudes towards STEM fields and their interests in STEM careers in terms of gender, and relationship between their attitudes towards STEM fields and their interests in STEM careers would provide guidance for the Ministry of Turkish National Education (MoNE) or other countries that are trying to integrate STEM education into their curricula, as well as ready to use the data for related studies in science education. This study can also make a significant contribution for policy makers in terms of providing empirical data for creating future research agenda in STEM education.

METHODS

The correlational method was used in this study. This method is used to determine the presence and the power of the relationship between two or more quantitative variables (Fraenkel and Wallen, 2003). To this end, in this study, the relationship between middle school students' attitudes towards STEM fields and their interest in STEM careers was examined.

Participants

Participants of the study consisted of 774 middle school students (478 female, 296 male) from 10 cities (Istanbul, Ankara, Zonguldak, Kocaeli, Konya, Muş, Mersin, Kahramanmaraş, Diyarbakır, Bitlis), located in 6 geographical regions of Turkey in fall semester of the 2017-2018 academic year. The reason why we selected middle schools from different regions was to be able to generalize our findings to a wider population in Turkey. Moreover, the selection of different regions of Turkey will provide a better cultural and educational representation of Turkey (Yilmaz-Tuzun & Topcu, 2008). The age range of participants was between 9-15 and 20.4% of the students are studying in the 5th grade, 30.0% of them are in the 6th grade, 22.9% of them are in the 7th grade and 26.7% of them are in the 8th grade. The detailed demographic information of the participants is given in Table 1.

Table 1. Information on the participants

	Attributes	F	%
Gender	Female	478	61.8
	Male	296	38.2
Grade level	5th grade	158	20.4
	6th grade	232	30.0
	7th grade	177	22.9
	8th grade	207	26.7
	Total	**774**	**100.0**

Data Collection Tools

In the present study, two scales and personal information form were used to determine the students' attitudes towards STEM fields and their interests in STEM careers in terms of gender, and

the relationship between their attitudes towards STEM fields and their interests in STEM careers. Personal information form consists of students' gender, grade levels, age, and their provinces. Detailed information about the STEM Attitude Scale and STEM Career Interest Survey (STEM-CIS) is given below.

STEM Attitude Scale

One of the scales utilized in the present study is STEM Attitude Scale developed by Friday Institute (2012) and adapted to Turkish by Gülhan and Sahin (2016). There are 37 items in this scale. Gülhan and Sahin (2016) calculated the Cronbach alpha reliability coefficient of the scale as .92. As a result of applying the scale to 774 middle school students, the Cronbach alpha reliability coefficient was calculated as .93 for STEM Attitude Scale in the present study. As a result of the confirmatory factor analysis, goodness of fit values for the model was determined as follows: RMSEA=.060, GFI=.86 CFI=.97, NFI=.96, NNFI=.97, AGFI= 0.84. When these values are examined, it is seen that the scale is fit for the sample of the present study.

STEM Career Interest Survey (STEM-CIS)

The second instrument is the STEM Career Interest Survey (STEM-CIS) developed by Kier et al. (2014) and adapted to Turkish by Koyunlu Unlu et al. (2016). This scale consists of 40 items. The Cronbach alpha reliability coefficient was calculated as 0.93 by Koyunlu Unlu et al. (2016). As a result of applying the scale to 774 middle school students, the Cronbach alpha reliability coefficient was calculated as 0.94 for STEM-CIS in the present study. As a result of confirmatory factor analysis, goodness of fit values for the model was determined as follows: RMSEA=.087, GFI=.76 CFI=.95, NFI=.94, NNFI=.95, AGFI= 0.73. When these values are examined, it is seen that the scale is fit for the sample of the present study.

Data Analysis

Frequency and percentage values were used for descriptive analysis of the participants' attributes. The Shapiro-Wilk test was used in order to test the normality assumption. The normality assumption was met. Since the necessary assumptions are met for the independent samples t-test, this test was used in comparing male and female students' scores. Pearson correlation method was used since normality assumption for each variable was met. Furthermore, simple linear regression was used in determining the relationship between students' attitudes towards STEM fields and their interests in STEM careers.

FINDINGS

The findings obtained from the present study are given under the headings of "students' attitudes towards STEM fields in terms of gender", "students' interest in STEM careers in terms of gender", and "relationship between attitudes towards STEM fields and interest in STEM careers".

Students' Attitudes towards STEM Fields in Terms of Gender

In this study, independent samples t-test was conducted in order to determine whether there is a significant difference between the scores of the male and female students. In this context, independent samples t-test was applied for the scale and the sub-dimensions. The results are reported in Table 2.

Table 2. Students' attitudes towards STEM fields considering gender

	Gender	N		SD	Df	T	p
STEM Attitude Scale	Female	478	144.91	21.62			
	Male	296	146.35	21.09	772	-.910	.36
Science Dimension	Female	478	35.79	6.82			
	Male	296	35.76	6.69	772	.054	.95
Mathematics Dimension	Female	478	30.81	7.20			
	Male	296	30.37	7.55	772	.798	.42
Engineering & Technology Dimension	Female	478	32.80	7.02			
	Male	296	35.56	6.83	772	-5.365	.00
21st Century Skills Dimension	Female	478	45.50	7.52			
	Male	296	44.64	7.74	772	1.518	.12

* $p<0.05$

As a result of the independent samples t-test, a significant difference between the scores of male and female students in terms of STEM attitude scale (t (772)= -.910, $p>.05$) was not found. As seen in Table 2, there was only a statistically significant difference between the scores of male and female students in favor of male students for the sub-dimension of "Engineering and Technology" (t (772)= -5.365, $p<.05$).

Students' Interest in STEM Careers in Terms of Gender

In the present study, independent samples t-test was conducted in order to determine whether there is a significant difference between the scores of the male and female students. In this context, independent samples t-test was applied for the scale and the sub-dimensions. The results are reported in Table 3.

Table 3. Students' interest in STEM careers considering gender

	Gender	N		SD	Df	T	p
STEM Career Interest Survey	Female	478	153.27	25.31			
	Male	296	157.47	24.88	772	-2.259	.02
Science Dimension	Female	478	40.59	7.23			
	Male	296	39.68	7.76	772	1.622	.10
Mathematics Dimension	Female	478	39.13	8.59			
	Male	296	38.30	8.85	772	1.293	.19
Technology Dimension	Female	478	38.04	8.31			
	Male	296	40.50	7.92	772	-4.082	.00
Engineering Dimension	Female	478	35.50	8.92			
	Male	296	38.98	8.38	772	-5.389	.00

* $p<0.05$

It is seen that there is a significant difference between male and female students in terms of general STEM career survey (t(772)= -2.259, $p<.05$) in Table 3. Considering the mean score in Table 3, it is seen that male students have higher interest scores. As seen in Table 3, there was a statistically significant difference between the scores of male and female students in favor of male students for the sub-dimensions of "Engineering" and "Technology".

Relationship between Attitudes towards STEM Fields and Interest in STEM Careers

In the present study, Pearson correlation coefficient was used in order to determine whether there is a relationship between the students' attitudes towards STEM fields and their interests in STEM Careers. The results are given in Table 4.

Table 4. Attitude towards STEM fields & interest in STEM careers

	Attitude towards STEM Fields	Interest in STEM Careers
Pearson Correlation	1.00	.655**
Sig. (2-tailed)	-	.000

Attitude towards STEM Fields	N	774	774
	Pearson Correlation	.655**	1.00
Interest in STEM Careers	Sig. (2-tailed)	.000	-
	N	774	774

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

When Table 4 is examined, it is seen that there is a moderately positive and significant relationship between middle school students' attitudes towards STEM fields and their interest in STEM careers, ($r = 0.655$, $p < .01$).

A simple linear regression analysis was run to determine the extent to which the attitude towards STEM explains the interest in STEM careers. In order to perform the simple linear regression analysis, the Durbin Watson value should be around 2. This value was found to be 1.909 for this study. In addition, in order to perform this analysis, there should be a linear relationship between the two variables and the variables should be normally distributed. All assumptions were met for simple linear regression. Since all these assumptions were met, a simple linear regression analysis was performed. The results obtained are given in the table below.

Table 5. Attitude towards STEM fields & interest in STEM careers

Variable	β weight	Adjusted R^2	F	p value
STEM attitude	.655	.428	580.490	.000

Dependent variable: STEM Career Interest

When the findings given in the table are examined, it is seen that the attitude towards STEM fields is a significant predictor of interest in STEM careers, Adjusted R^2 =0.428, F (1,772)= 580.490, p<.01. It can be stated that about 43% of the total variance related to interest in STEM careers is explained with the attitude towards STEM fields.

DISCUSSION AND CONCLUSION

The results of the present study shed light on an important social issue related to encouraging female and male students to engage in STEM fields and STEM careers. In the 21st century, growth in STEM careers is faster than the one in non-STEM careers (Langdon et al., 2011). Therefore, the need for individuals working in STEM careers has increased. This situation has affected the countries' education policies. In the present study, middle school students' attitudes towards STEM fields and their interests in STEM careers are examined in terms of gender variable. In addition, the relationship between their attitudes towards STEM fields and their interest in STEM careers is examined.

Regarding the first research question, *How do middle school students' attitudes towards STEM fields change considering their gender?,* our findings reinforce previous research that attitudes towards engineering and technology differ in terms of gender (cf., Mahoney, 2009; Unfried et al., 2014). In the present study, a significant difference was found in favor of male students only in engineering and the technology sub-dimension. Male students have more positive attitudes towards engineering and technology fields than female students. Likewise, Unfried et al. (2014) and Mahoney (2009) found that female students have attitudes less positive than those of male students towards engineering and technology in STEM fields. Educationalists often emphasize that male students are more successful than female students in the STEM fields (Knezek, Christensen and Tyler-Wood, 2011). Similarly, it was concluded in the study of Weinburgh (1995) that in science, male students are more successful and have more positive attitudes than female students.

In the present study, it was determined that students' interests in STEM careers also significantly differed in terms of gender. Similarly, in some studies it was reported that interests in STEM careers differ in terms of gender (Christidou, 2006; Sadler et al., 2012; Unfried et al., 2014; Ünlü and Dökme, 2018). In comparison of interests in STEM careers in terms of gender, male students

scored higher than female students. In the present study, it was found that female students had less interest in the careers related to engineering and technology than male students. Similarly, Sadler et al. (2012) and Unfried et al. (2014) reported that the interests of female students in STEM careers were low especially in engineering and technology careers. In addition, female students' low interests in science, technology, engineering and mathematics fields support SCCT (Ünlü and Dökme, 2018).

In the present study, many factors may affect the emergence of these findings. Some of these factors are self-efficacy (Lent et al., 2005, Scott and Mallinckrodt, 2005; Tang et al., 2008); outcome expectations, and social support (Lent et al., 2005; Mutlu and Korkut-Owen, 2017); and gender stereotype (Dasgupta and Stout, 2014; Gottfredson, 2005; Sadler et al., 2012; Shapiro and Williams, 2012). Konrad, Ritchie, Lieb and Corrigall (2000) emphasize that gender stereotypes lead females to social activities, to be helpful, to care about a baby and to interpersonal relationships. It is also thought that STEM careers are more suitable for males (Cooper and Heaverlo, 2013). Therefore, these historical and invalid stereotypes negatively affect the interest and attitudes of girls to STEM fields and STEM careers (Cooper and Heaverlo, 2013). The divergence of interest and attitude towards the STEM fields and STEM careers may be due to the different experiences of males and females (Allan and Madden, 2003; Wyss et al., 2012). Parents also have a critical importance in influencing their children's interests and attitudes towards STEM fields and STEM careers (Dasgupta and Stout, 2014). Individuals working in STEM fields in the family can be role model for female students (Ünlü and Dökme, 2018). Moreover, the toys with which children play can also affect career choice. This is because girls are leaded to play with dolls or household appliances at early ages at while boys are leaded to play with toys like cars (Kalan, 2010). In this respect, it can be said that it is necessary to contribute to girls' and boys' having experience in STEM fields at their early ages.

Historically speaking, women are underrepresented in STEM fields (Craig et al., 2018; Ivie and Tesfaye, 2012; LeGrand, 2013; OECD, 2006; Smith, 2011). This suggests that educators should exert further efforts in this field (Unfried et al., 2014). For their sufficient inclusion into these areas, their interests in STEM fields and careers may be improved. The decision of a female student to pursue a career in STEM fields can be affected by a female role model, such as a teacher (Bokova, 2017; Fried and MacCleave, 2009). To this end, female teachers should encourage female students in this regard. In addition, STEM-related after-school activities and summer camps can be organized for female students (Dasgupta and Stout, 2014).

It is important to inform students about STEM careers in order to sustain and enhance the existing interests of students in STEM careers. Informing students about STEM careers is important to ensure competition in the global market (Wyss et al., 2012). Furthermore, middle school period is significant in terms of focusing on career development (Wyss et al., 2012). Therefore, middle school students should be informed about STEM careers, regardless of gender and should be trained according to the requirements of the 21st century. In studies, it is stated that students acquire information about careers directly from the teachers (Wellcome Trust Monitor, 2013). To this end, teachers can relate the professional roles in STEM fields to the curriculum (Watermeyer, Morton and Collins, 2016). Teachers can also show videos about STEM careers to the students in line with the curriculum in classrooms. For example, while students learn about plant morphology or plant pathology, they can also watch interviews held with a gardener (Wyss et al., 2012). Over and above, teachers and pre-service teachers need to be well educated about STEM fields and its teaching methods.

In this study, a positive correlation between the middle school students' attitudes towards STEM fields and their interests in STEM careers was determined. Simple linear regression results indicate that approximately 43% of the total variance of interest in STEM careers stems from attitudes towards STEM. Based on the results of present study, it can be said that the attitude towards STEM is an important factor in determining the interest in STEM careers. Similarly, Wiebe et al. (2018) state that there is a relationship between the attitude towards STEM and interest in STEM careers. In another study, Aydın, Saka, and Guzey (2017) concluded that students with a high level of attitude towards STEM would prefer to choose professions in STEM field. This result shows that there is a

relation between the attitude towards STEM and interest in STEM careers. According to the interview conducted with university students, Sarıkaya and Khorshid (2009) determined that the students preferred their current department according to their previous positive opinions about the profession. Therefore, learning environments should be established in schools aimed at helping students develop positive attitudes and views towards STEM careers so that students will grow interest in STEM careers. According to the SCCT, learning experiences are an important factor in the interest in STEM careers (Chachashvili-Bolotin et al., 2016). Therefore, it is necessary to ensure that students acquire positive learning experiences in STEM fields in schools.

Suggestions for Future Research

This study was solely interested in gender impact on attitudes towards STEM fields and interests in STEM careers. Further studies may investigate other potential factors that influence students' attitudes towards STEM fields and their interests in STEM related careers. Additionally, further studies can investigate why female students are less interested in STEM fields and STEM careers than male students. In addition, the effect of all components of SCCT on interests in STEM careers can be examined through different studies. Furthermore, a more detailed longitudinal study can be conducted to measure students' attitudes towards STEM and their interests in STEM careers, during their high school years.

Note

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