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Low Socioeconomic Status Students' STEM Career Interest in Relation to Gender, Grade Level, and STEM Attitude*

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ABSTRACT

This study investigated low socioeconomic status middle school students' STEM career interest (in areas of physical science, life science, technology, engineering, and mathematics) in relation to demographic variables of gender and grade level and also attitudes towards STEM areas (science, math, engineering, and 21st century skills). The sample of the study consisted of 263 sixth, seventh, and eighth grade students attending one of five middle schools located in the rural areas of a city in the northeast region of Turkey. Analysis results showed that students had positive feelings in having a STEM career and these perceptions did not differ in terms of gender and grade level. Moreover, students' STEM career interest was high for both males and females. Among three grade levels, there was no significant difference in terms of STEM career interest, except for life science. Besides, canonical correlation analysis showed that students' career interest in STEM was positively related to students' attitudes towards STEM fields. Turkish low socioeconomic status middle school students have limited information about STEM career options and they should be given sufficient guidance about STEM occupations during middle school years. Additionally, we suggest investigating the ways of enhancing students' STEM career interest in further studies.

Keywords: Middle School; Socioeconomic Status; STEM Attitude; STEM Career Interest; STEM Education.

INTRODUCTION

Nowadays, the common motivation for nations is that improving educational system to make new generation much innovative and creative (Lederman, 2008). The main reason for this motivation is changing needs of the world. For instance, Organization for Economic Co-operation and Development, OECD, suggested that the technological revolution has shown its effects in many aspects of life, including economies of countries; hence, expectations for 21st century economies have changed (Outlook, 2013). Moreover, the same report refers to key information process skills, problem solving in technology-rich environments, and productivity as the 21st century skills which should be gained by individuals to keep up with these changes. Therefore, the global economy encourages individuals to be prepared for science, technology, engineering, and mathematics (STEM) professions. In other words, the role of STEM

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education in future's economy is recognized by nations, so it has become priority to improve students' STEM learning (McMahon & Showers, 2011). Although, the definition of STEM learning is a gap in the relevant literature, Lamb, Akmal, and Petrie (2015) describe it as "the acquisition of knowledge and skills through experience and study integrated though multiple lens allowing for the appreciation of the encompassing complexity and cross-cutting ideas across the STEM disciplines as a whole" (p. 411). In view of these researchers, STEM learning is considered by curriculum researchers in two ways; (1) interdependent and (2) integrating multiple disciplines into practices. In other words, STEM education comprises the knowledge, skills, and beliefs which also make STEM subject areas interconnected (Çorlu, Capraro, & Capraro, 2014).

United States consultants stated that STEM skills are necessary for everyone. Namely, they are not only for people who want to engage in STEM occupation, but also for people who are in non-STEM occupations (National Governors Association, 2011). U.S. consultants also underline the importance of STEM for workforce. Moreover, they suggest that even non-STEM fields, having STEM competencies will put in individuals front. Recently, STEM is also one of the hot topics of Ministry of Turkish National Education (MoNE). MoNE emphasizes importance of STEM for 2023 aims and intends to enhance students' inquiry, research, and evaluation skills which are critical to handle real life problems. While solving problems, students are targeted to learn science, technology, mathematics, and engineering fields (Cantürk, 2016). Therefore, the governments want to give priority to create scientifically literate populations. For example, PISA and TIMSS are international programs which assess middle school students' scientific and mathematical literacy. According to the results, China, Singapore, Korea, and Finland are high achieving countries. Regarding Turkey, the results are underwhelming. Turkish students' scores are below the average of OECD countries (MoNE, 2013). On the other hand, PISA 2012 results suggest that there is an increase in students' science and math literacy for many countries. Despite this positive change in students' science and math literacy, many capable students do not prefer STEM related careers in many countries such as United States (National Science Foundation, 2010). Turkey is also one of the countries that should encourage students to prefer STEM related careers. For instance, Korkut-Owen, Kelecioğlu, and Owen (2014) investigated Turkish students' career selection trends for the last 11 years based on the data from Evaluation, Selection and Placement Center. According to the results, careers about engineering have been selected by about 13% of students and this percentage did not change from 2002 to 2012. Moreover, the percentage of students who attended a college to study positive and natural sciences decreased from 13% to 8%. On the other hand, trends on studying social science are on the increase. In 2002, 22% of students entered to a college to study social sciences, while in 2012, 36% of the students entered to a college to study social sciences. Therefore, Korkut-Owen et al. suggested that the decline on positive and natural sciences and the stability on engineering should be considered to develop some solutions by policy makers.

One of the underrepresented groups in STEM related fields is socioeconomically disadvantaged individuals (Shaw & Barbuti, 2010). For example, Leslie, McClure, and Oaxaca (1998) suggest that parents' education and income level are significant predictors of students' college selection, especially for technical fields. The Royal Society (2008) suggests that the majority of people who study science, specifically physical science, at universities are those who come from high socioeconomic status groups. Actually, students' socioeconomic backgrounds' effects have been seen in early ages. For instance, international studies like TIMSS suggest that home background is a significant predictor of both science and math achievement (Gustafsson, Hansen, & Rosén, 2011). STEM education for low socioeconomic groups is important since it would expand individuals' not only economic opportunities, but also social opportunities (MacPhee, Farro, & Canetto, 2013). Recently, some studies investigated the effects of some STEM oriented interventions on students' STEM career interest and found positive effects (e.g., Peterman, Kermish-Allen, Knezek, Christensen, & Tyler-Wood, 2016; Xie & Reider, 2014). Moreover, pre-high school experiences are important for students' career choice in the future (Sadler, Sonnert, Hazari, & Tai, 2012). Therefore, the present study has two major aims: to investigate low socioeconomic students' career interest in relation to (1) gender and grade level and (2) STEM attitude.

STEM Career Interest in Relation to STEM Attitude

The level of students' interest in STEM careers is important to predict their future career choice. Studies showed that students' choosing a STEM career and maintaining their major in college depended on their interest in STEM careers (Astin & Astin, 1993; Maltese & Tai, 2011). For example, in a study with college students, Bonous-Harnmarth (2000) found that students' persistence was more strongly associated with their intention to major in STEM fields than their average high school achievement scores. Similarly, Astin and Astin (1993) examined the college students' retention rates in STEM majors in US and found a substantial loss of students from these majors. They also determined the science based career aspiration (measured at the first year in college) as one of the factors affecting students' possibility of completing majors in STEM fields. Sadler et al. (2012) found students' career interest at the beginning of the high school to be as the best factor to predict their career interest at the end of the high school. They emphasized the importance of the pre-high school experiences in young students' career intention. Thus, with the purpose of enhancing the number of people in STEM career fields, it is rational to focus on middle school students' career interest and examine the factors related to their interest. In Maltese and Tai's (2011) longitudinal study, eight grade students who were interested in science career and found science useful for their future were more likely to get a degree in STEM fields. Additionally, Maltese and Tai stated that students' early career interest played an important role in students' persistence in STEM major, however; middle school students' awareness about STEM career options were very limited. One of the aims of the present study is to figure out the low socioeconomic status middle school students' future career choice profiles. Hence, this study will help to expand our understanding in low socioeconomic status students' STEM career interest and awareness about these career options.

In this study, we utilize the Social Cognitive Career Theory (SCCT; Lent, Brown, & Hackett, 2000). The SCCT proposes that students' STEM career interest is influenced from students' attitudes toward STEM fields (Lent, et al., 2000). Unfried, Faber, Stanhope, and Wiebe (2015) considered STEM attitude as the composite of self-efficacy and outcome expectancy beliefs. According to SCCT, individuals' career and academic interest, education and vocational plans, and their success in their career plans are influenced from the interplay among personal, environmental, and behavioral factors (Lent et al., 2008). Namely, SCCT illustrates career choice and career interest of individuals with their self-efficacy beliefs ("beliefs about one's ability to successfully perform particular behaviors or courses of action") and outcome expectancy ("beliefs about the consequences of given actions") (Lent et al., 2008, p. 55). Recent research has also provided empirical evidence about the relationships between students' STEM career interest and STEM attitude measures. For instance, in a study, Milner, Horan, and Tracey (2013) investigated the relation between college students' STEM career interest and STEM career self-efficacy. The correlational analysis showed that there was a positive and high correlation between the two variables (r= .70). In another study, Riegle-Crumb, Moore, and Ramos-Wada (2011) investigated eighth grade students' science and math career aspirations in relation to attitude measures of enjoying science/math and science/math self-concept. It was found that both enjoying science and science self-concept were significantly and positively associated with science career aspirations. Similarly, enjoying math and math self-concept significantly and positively predicted math career aspirations. Furthermore, Tyler-Wood, Knezek, and Christensen (2010) examined the relationship between middle school students' STEM career interest and their learner dispositions of computer enjoyment, computer importance, motivation/persistence, study habits, empathy, creative tendencies, and attitude toward school. Except empathy, STEM career interest was significantly related to other all measures of learner disposition and the correlations ranged from .30 to .53. Based on these studies' findings, we expect that there will be a positive relationship between students' STEM career interest and STEM attitude.

Gender and Grade Level Differences in Students' STEM Career Interests

According to the SCCT, personal inputs like background variables are also important for individual's career choice (Lent et al., 2000). Relevant research suggests that female students tend to prefer university programs on some careers which are socially perceived to be appropriate for women (e.g., Griffith, 2010; Severins, & ten Dam, 2012). National Science Foundation of U.S. (2013) reported that female students choose careers such as nursing or psychologist, and show lower tendency to choose careers such as math or computer sciences. Similarly in Turkey, female students’ careers choices are influenced from gender roles (Korkut-Owen, Kepir, Özdemir, Ulaş, & Yılmaz, 2012). For example, Korkut-Owen et al. (2014) investigated Turkish students' university enrollment trends regarding to gender. Analysis showed that, in STEM fields, there were more males than females. Especially engineering was seen as a male dominant career. However, when the trend between 2002 and 2012 was considered, the gap between males and females on STEM fields was on decrease. The decrease of this gap between females and males may be an outcome of positive female discrimination policy of National Education of Turkey (Çalık, Ültay, Kolomuç, & Aytar, 2015). Sadler et al. (2012) discussed that although gender differences in STEM career interest was frequently studied by researchers, there was a mystery about which years were the most important on emerging these gender differences. With this purpose, they conducted a study to examine the gender gap in students' STEM career interest during the high school. The authors found that at the beginning of high school, there was a large gender difference between females' and males' STEM career interest. Additionally, they found that the number of male students with STEM career intentions were higher than the number of female students at both the beginning and the end of high school. Thus, they suggested that pre-high school activities are important for STEM career interest, especially to focus on increasing female students' interest. Hence, it is important to investigate students' STEM career interest regarding to gender in lower ages. Furthermore, although Unfried, Faber, and Wiebe (2014) found parallel declines in career interests for male and female students across grade levels (elementary, middle and high school) in the fields of physics, biology and zoology, veterinary work, mathematics, earth science, computer science, and energy, they found different trends in the fields of environmental work, medicine, medical science, chemistry, and engineering. Female students stated lower level of interest in STEM careers than males in most of these fields, especially in the field of engineering. They pointed out the need for more efforts in these fields to educators. In the light of the relevant literature, following research questions were asked in the present study:

1. What is the level of low socioeconomic status students' perceptions of a career in STEM areas and does this level differ in regard to students' gender and grade level?
2. What is the low socioeconomic status students' STEM career interest profile?
3. What are the low socioeconomic status students' career plans?
4. Is there a gender and grade level difference in low socioeconomic status students' STEM career interest?

5. Is there a relationship between low socioeconomic status students' STEM career interest and STEM attitude?

METHODOLOGY

The research design of the present study was cross-sectional survey method. Participants and data collection tools are explained below.

a) Sample

The participants of this study include 263 students from 5 middle schools located in the rural areas of a city in the northeast region of Turkey. 50% of them were females, and 46% of them were males, while 4% of the participants did not report their sexes. Most of the participants (70%) were from 7th grade while 13% of the participants were from 6th grade and 17% of them were from 8th grade. Students were from low socio economic families. Namely, all of the mothers of students were housewife. Additionally, approximately 35% of the fathers worked as a farmer or in animal husbandry and 10% of the fathers were unemployed. Except a few of them, remaining fathers were labor in several works such as construction worker and janitor. Regarding to educational level of parents, most of mothers (93%) and fathers (86%) were graduated from middle school or lower. 32% of students have 6 or more siblings, and only 9% of them have less than 3 siblings. Most of the students (70%) do not have a computer at their home.

b) Instruments

The STEM Semantic Survey for Career Interest: This survey was developed by Tyler-Wood, Knezek, and Christensen (2010) to examine middle school students' perceptions about a STEM career (see Appendix-1). Five adjective pairs based on a 7-point response scale were used and Cronbach alpha was .93. In the present study, these adjective pairs were translated in Turkish by the researchers and examined by a language expert (See Appendix-1). Students were asked to rate their response on the 7 point scale between the related adjective pairs to state the degree of their interest in STEM careers. Although the first and second adjectives were placed from negative to positive, remaining adjectives were from positive to negative. To make the interpretations simpler, last three items were reverse coded. Cronbach alpha was found to be .75, indicating sufficient internal consistency of the scores.

Student Attitudes toward STEM (S-STEM) scale: S-STEM scale was developed by Unfried et al., (2015) based on items in Friday Institute for Educational Innovation Survey (2012) and adapted for Turkish middle school students by Yıldırım and Selvi (2015). This scale is used to measure students' attitudes toward STEM disciplines based on four factors: science (9 items, 1 of them is reverse), math (8 items, 3 of them are reverse), engineering and technology (9 items), and 21st century skills (11 items). Response scale is based on a likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Yıldırım and Selvi provided evidence for the construct validity of S-STEM with Turkish sample by confirmatory factor analysis (χ^2/df= 4.72, RMSEA= .06, SRMR=.05, CFI= .96, NFI= .95) Cronbach alphas of the subscales were ranged from .86 and .89. In the present study, CFA results (χ^2/df= 1.97, RMSEA= .06, SRMR= .07, CFI= .96, NNFI= .95) indicated good model fit to the data, as well. Sample items for each subscale and Cronbach alphas obtained from this study were presented in Table 1.

Table 1. *Sample Items and Cronbach Alphas for Subscales of S-STEM (Unfried et al., 2015)*

Subscale	Sample Item	Cronbach Alpha
Science	"Science will be important to me in my future career"	.86
Math	"I am the type of student who does well in math"	.71
Engineering and Technology	"Designing products or structures will be important in my future jobs"	.86
21st century skills	"I am the type of student who does well in math"	.90

STEM Career Interest Scale: Researchers designed a 5-item survey to descriptively examine the level of students' interest toward STEM careers. In this process, researchers benefited from STEM occupations which were categorized by Milner, Horan, and Tracey (2014, p. 645) and STEM career interest survey of Unfried, et al., (2014) (see Appendix-2). Each item represents a category of related STEM area: physical science, life science, technology, engineering, and mathematics. Each category includes from 4 to 10 sample jobs. Students were asked to rate their interest level to each STEM area and careers on a Likert scale ranging from 1 (I am not interested at all) to 4 (I am very interested). For example, the first item asked students interest toward physical science area and gave some career examples about this area such as astronomer, biophysicist, geoscientist, and physicist.

FINDINGS

Students' Perceptions of a Career in STEM

In order to answer the first research question (What is the level of students' perceptions of a career in STEM areas and does this level differ in regard to students' gender and grade level?), students were asked about their feelings regarding a STEM career. They rated their perceptions about having a STEM career as means a lot, interesting, exciting, fascinating, and appealing on a 7 point Likert scale. An average score was computed by students' responses to 5-questions of semantic test. As shown in Table 2, students' average semantic perceptions of STEM areas were ranged between 5.55 and 6.19 which are above the mid-point (4) of 7 point Likert scale. It indicated that females' and males' responses were close to each other at each grade level and they have very positive feelings toward STEM careers. Then, a two-way ANOVA was performed to examine the gender and grade level (6^{th}, 7^{th}, and 8^{th}) differences in students' STEM perceptions. No significant interaction effect was found for these variables [$F(2,245)= 1.83$, $p= .16$]. Moreover, no significant main effects for gender [$F(1,245)= 1.14$, $p= .29$] and for grade levels [$F(2,245)= .30$, $p= .75$] were found.

Table 2. *Average STEM Career Perceptions of Different Graders*

Gender	Grade	Mean	SD
Males	6	5.61	.31
	7	5.55	.13
	8	5.91	.31
Females	6	5.76	.30
	7	6.19	.13
	8	5.79	.24

Low Socioeconomic Status Students' STEM Career Interest Profiles

Students were asked to rate their interest in STEM occupations on a Likert scale ranging from 1 (not interested at all) to 4 (very interested). STEM occupations included five categories which are physical sciences, life sciences, technology, engineering, and mathematics. To ease the interpretation, we combined 'not at all interested' and 'not interested' categories into 'not interested' category, and 'interested' and 'very interested' categories into 'interested' category. Since some of the students did not answer these questions, they were not included in a category. The frequencies of students' STEM career interest in 'not interested' and 'interested' categories were presented at Table 3.

Table 3. *Frequencies of Students' STEM Career Interest*

	6th Grade (*N*=36)		7th Grade (*N*=183)		8th Grade (*N*=44)	
	Interested	**Not interested**	**Interested**	**Not interested**	**Interested**	**Not interested**
Physical Science	75%	22%	76%	23%	75%	25%
Life Science	86%	11%	67%	31%	84%	16%
Technology	75%	19%	71%	25%	66%	32%
Engineering	72%	8%	75%	22%	61%	36%
Mathematics	72%	26%	69%	23%	57%	36%

Career Plan Profiles

The third research question was aimed to descriptively examine the career plan profiles of middle school students from low socioeconomic status. In this respect, students were asked to answer to an open-ended question that "In future, which occupation do you want to work?" Students were asked to state the reason why they want to work in that occupation, too. Students' responses were categorized within five STEM areas: physical science, life science, technology, engineering, and math. As presented in Table 4, results showed that 48% of students reported occupations different from STEM field. Besides, majority of the students who stated a STEM profession, 36% of the sample, reported the occupations in the field of life science. In this field the most popular response among the students (more than half) is the medical doctor followed by nursing. The second field was engineering and about 11% of the students want to work in several engineering areas such as electrical engineering, civil engineering, and architecture. Moreover, only a few students (4%) stated science and math related occupations as their future plan. Lastly, 48% of the participants stated some occupations (such as soccer player, singer, teacher, lawyer, and police) that were not categorized under these STEM areas. Interestingly, none of the students reported an occupation in the field of technology.

Regarding the reason why students want to work in this occupation, only the answers which were in life science and engineering were examined since they were the most frequently targeted STEM occupation areas among these participants. Students' answers were investigated separately for each STEM area. In the life science area 50 of 95 students stated their reason as helping sick people or saving people's life. Another group of students (n=31), reported their interest or enjoyment to the related occupation. Remaining students either did not answer to this question or stated different reasons such as that important people in their life want them to choose this occupation. In the engineering area, 25 of 30 students stated that they would like to be an engineer because they were interested in engineering profession, in other words, they reported that they enjoyed what engineers do. Only 5 of 30 students reported different reasons for wanting to be an engineer in the future. For example, one of them reported that s/he wants to help people by creating new places for them. One of them stated that s/he wanted to contribute to the culture by his or her design. Other 3 students, who reported that they would like to be engineer in the future, explained their reason due to high salary of engineering occupation.

Table 4. *Frequencies and Percentages of Students' Career Plans*

Career	Frequency	Percentage
Physical Science	8	3 %
Life Science	95	36 %
Technology	-	0 %
Engineering	30	11 %
Math	3	1 %
Others	127	48 %

Gender and grade level difference in students' STEM career interest

On the combined categories in students' STEM career interest (we have combined 'not at all interested' and 'not interested' categories into 'not interested' category, and 'interested' and 'very interested' categories into 'interested' category) gender and grade level differences were examined. In order to investigate whether students' interest in physical sciences, life sciences, technology, engineering, and mathematics differ in terms of gender, chi-square tests for independence (with Yates Continuity Correction) were performed. Analysis results showed no significant associations between gender and career interest in physical sciences [χ^2 (1, n= 249)= 2.06, p= .15)]; gender and career interest in life sciences [χ^2(1, n= 247)= .73, p= .39]; gender and career interest in technology [χ^2 (1, n= 242)= .06, p= .81)]; gender and career interest in engineering [χ^2 (1, n= 244)= 1.37, p= .24)]; and gender and career interest in mathematics [χ^2 (1, n= 234)= 1.29, p= .26)]. Therefore, analysis results showed that females and males did not differ from one another in regard to their interest in any of the STEM occupations.

In order to investigate whether students' interest in STEM occupations differ in terms of grade level, chi-square tests for independence were conducted. Analysis results showed that there were significant differences among grade levels in terms of only career interest in life sciences [χ^2(2, n= 258)= 8.80, p= .01)]. Follow-up tests showed that the difference was between sixth and seventh grade students [χ^2(1, n= 214)= 4.78, p= .03)]. The probability of sixth grade students' being interested in a life sciences career was about 1.29 times (.89/.69) greater than seventh grade students'. Eighth graders did not differ from neither sixth nor seventh graders in terms of life sciences career interest. In rest of the STEM occupations, no grade level differences were detected. In other words, no significant associations between grade level and career interest in physical sciences [χ^2 (2, n= 260)= .07, p= .97)]; grade level and career interest in technology [χ^2 (2, n= 253)= 1.43, p= .49)]; grade level and career interest in engineering [χ^2 (2, n= 255)= 3.74, p= .15)]; and grade level and career interest in mathematics [χ^2 (2, n= 245)= 3.39, p= .18)] were found. Thus, other than career interest in life sciences, no grade level differences were detected.

Relationship between STEM Career Interest and Attitude toward STEM Areas

Initially, participants' attitudes toward STEM areas were examined. Mean scores were above the midpoint of 5 point Likert scale (for math *M*= 3.58, *SD*= .73; for science *M*= 3.94, *SD*= .83; for engineering *M*= 3.72, *SD*= .85; and for 21st century skills *M*= 3.90, *SD*= .81). These results indicated that students had positive attitudes towards STEM areas.

Canonical correlation analysis was performed to investigate the relationship between the set of students' STEM attitudes (math, science, engineering, and 21st century skills) and the set of STEM career interest (physical science, life science, technology, engineering, and math). With all four canonical correlations included, F (20, 760) = 3.93, p < .005, and with the first canonical correlation removed, F (12, 608) = 2. 32, p < .005. Subsequent F tests were not statistically significant. Therefore, only the first canonical variate accounted for the significant relationships between the two sets of variables. The first canonical correlation was .43 (19% overlapping variance), the second was .27 (6% overlapping variance) accounting for the significant relationships between the two sets of variables. Since the overlapping variance in the second canonical variate pairs was very low (under %9) it was avoided from interpreting it (Tabachnick & Fidell, 2013).

As shown in Table 5, with a cut off correlation of .30 (Tabachnick & Fidell, 2013), all of the variables in the STEM attitude set (i.e., attitude toward Math, Science, Engineering and 21st century skills) were positively and significantly correlated with the first canonical variate. Concerning STEM career interest variables, physical science, life science and engineering were found to be positively and significantly correlated with the first canonical variate while technology was not found significantly related to this canonical variate. Accordingly, the first pair of canonical variates suggested that higher level of STEM attitude was positively related with higher level of STEM career interest. Math interest (.71) and math attitude (.92) had the highest loadings among the variables within the related variable set. The coefficients obtained from canonical correlation analysis were presented in Table 5.

Table 5. *Correlations, Standardized Canonical Coefficients, Canonical Correlations, Percent of Variance, and Redundancies*

	First Canonical Variate	
	Correlation	**Coefficient**
SET 1: STEM attitude		
Math	.92	.81
Science	.49	-.25
Engineering	.43	-.06
21st century skills	.71	.57
Percent of variance	44.14	
Redundancy	8.29	
SET 2: STEM career interest		
Physical Science	.65	.42
Life Science	.32	.13
Technology	-.04	-.16
Engineering	.63	.46
Math	.71	.55
Percent of variance	28.57	
Redundancy	5.36	
Canonical correlation	.43	

DISCUSSION and CONCLUSION

The present study has two major aims; to investigate low socio economic students' career interest in relation to (1) gender and grade level and (2) STEM attitude. For the first aim of the study, students' perceptions about STEM fields, their STEM career interest, and students' career plans were examined with regard to gender and grade level. Firstly, students' perceptions about STEM areas were investigated by asking students to rate how they feel about a career in STEM areas. Results suggested that low group students' average scores were close to the highest score (7) which indicated the most positive feelings. Namely, students reported that STEM careers means a lot for them and they found STEM careers highly interesting, exciting, fascinating and appealing. To investigate whether students' perceptions about a career in STEM areas differ in terms of gender and grade level, two-way ANOVA was conducted. According to the analysis results, there was no significant difference between females and males and among the three grade levels in their STEM career perceptions. Hence, it can be inferred that low socioeconomic status middle school students have positive perceptions in having career in STEM fields regardless of gender. According to Tyler-Wood, Knezek, and Christensen (2010), determining students' perceptions about STEM careers is important to identify their career potential. At this early stage of the education, students' positive perception about having a career in STEM areas is promising for the number of people in STEM careers in future.

Regarding students' STEM career interest profile, the descriptive results suggested that majority of the students were interested in having a STEM related careers which were grouped within five categories: physical science, life science, technology, engineering, and mathematics. To investigate whether females and males differ in terms of STEM career interest, chi-square tests for independence was conducted. Results suggested that there was no significant difference between females and males. Actually, it was an unexpected result since it was hypothesized that males have more STEM career interest than females based on the relevant literature (e.g., Unfried et al., 2014). One of the reasons of this surprising result may be because of students' age. Namely, middle school students have limited knowledge about career options. Although one of the aims of the primary and middle school science curricula is to improve students' awareness about science related careers (MoNE, 2013), in-class activities may not sufficiently emphasize this issue, in practice. Thus, we suggest future studies to investigate what extend science teachers provide information about science related careers and carry out these activities in their classes. Students' socioeconomic status may be another reason for similarities between males and females in STEM career interest. Related literature suggests that financial advantage of STEM careers is one of the underlining motivations of males to choose STEM careers (Correl, 2001; Dick & Rallis, 1991). Since, our sample is from the low socioeconomic status families, the limitations of low socioeconomic status may also encourage females to be interested in high salary jobs which are mostly in STEM fields. Future studies can investigate low socioeconomic status students' career interest with more details by using qualitative research methods.

To investigate whether students' interest in STEM careers differ in terms of grade level, chi-square tests for independence were conducted. Findings suggested that there was no significant difference among 6^{th} graders, 7^{th} graders and 8^{th} graders in terms of STEM career interest in all STEM fields, except for life sciences. These findings indicated that whether students being interested or not interested in STEM career was not influenced by grade level as far as we expected. Sadler et al. (2012) suggested that pre-high school activities are important to improve students' interest in STEM careers. However, findings of the present study indicated that there was not any developmental difference in students' STEM career interest through Grade 6 to Grade 8. In other words, activities in which students were engaged during middle school are not sufficient to improve students' STEM career interest. By considering the stability in students' STEM interest level during the high school (Sadler et al., 2012), the importance of the education in middle school can be better understood. Hence, science curricula can be enriched by integrating STEM related activities to support students' interest in STEM related careers. Regarding Turkey, Sarıer (2010) suggests that each student in Turkey does not have opportunity to take a high quality education in STEM. Although science curriculum in Turkey suggests harmony of science and mathematics teachers in their coursework (MoNE, 2005, 2013), the science and mathematics courses are not linked in practice (Özden, 2007). The new science curriculum (MoNE, 2013) highly emphasizes integration of technology in students' research and inquiry activities, relating science and technology, and enhancing science career awareness among students. However, to what extent these aims are achieved in science classes need to be investigated.

Students' career plans for the future were investigated by asking the question "In future, which occupation do you want to work?" According to the students' responses, life sciences area was predominated among low socioeconomic status students who stated STEM related occupations. Social popularity may be one of the reasons of why majority of students prefer to have a life science career in the future. In Turkey, education is highly valued by society. Besides, Turkish education system is competitive. Hence, parents encourage their children to have a good career and have good life standards (e.g., Şenler & Sungur, 2009). Because of the characteristics of Turkish culture, individuals consider others' opinions while decision making. Having a career in a life science, especially being a medical doctor is very popular in Turkey, not only among students but also among parents of students. According to a research (“Career choice”, 2013) in Turkey, one of five parents expects their children to be a doctor in their future. Engineering followed life science; the second popular STEM career among the participants was engineering. Besides that, unexpectedly, no student stated an occupation related to technology. Lack of occupation knowledge may lead students to focus on widely recognized occupations. Nowadays, Turkish policy makers take actions to raise students' awareness in technology related careers. For instance, with the demand of the Ministry of Industry, Ministry of National Education has begun to consider including a new course on software coding in both middle school and high school curricula (Ülkar, 2016). On the other hand, nearly half of the students stated occupations different than STEM related professions, which was a surprising result since findings of this study also suggested that students have high interest in STEM careers and positive perceptions about STEM areas. One of the reasons of why students did not report STEM related jobs so much may be because of the lack of knowledge about various career options. This may be caused by their social environment. Our sample was derived from a population that mostly family members work in agriculture, animal husbandry or building worker. Generally, educational level of parents is low. These situations may make these students disadvantaged about being aware of STEM careers. They may need a role model for leading to prefer various STEM occupations. Since these students do not have such a support from their families, the role of schools is getting more important. Actually, in Turkey, middle school students are provided with insufficient guidance about their career plans. Moreover, the existent guidance at school is limited with the information about transition from high school to university. Although it is discussed by policy makers to extend career guidance into middle schools, this type of training is available for only eighth grade students (Yeşilyaprak, 2012).

The second aim of the present study was to investigate the relation between low socioeconomic status students' STEM career interest and their STEM attitude. The canonical correlation analysis suggested that higher level of STEM attitude was positively related to higher level of interest in STEM careers, except technology. In other words, students who have positive attitudes towards science, math, engineering, and 21st century skills tend to be interested in careers in physical science, life science, engineering and math. Math and 21st

century skills had high loadings among STEM attitude variables. Regarding STEM career interest variables, math, physical science, and engineering had high loadings. Based on these high loadings, it can be suggested that higher level of students' math and 21st century skills related to higher interest in physical science, math, and engineering which are also known as difficult and less preferred careers in comparison to other STEM careers. The positive relation between STEM attitude and STEM interest also supports Lent et al.'s (2008) model which was based on SCCT theory. In this model, Lent et al. proposed that students' interest to an academic subject can be enhanced by high self-efficacy and positive outcome expectation in this subject. Similar findings were found for STEM career interest in several studies (e.g., Milner et al., 2013; Unfried et al., 2015). Therefore, in order to increase students' STEM career interest, enhancing their attitudes towards STEM fields is important, especially for low socioeconomic status students in young ages.

There are some limitations for this study. Firstly, it is a cross-sectional study, so the results do not imply cause-effect relationship. Future studies can use experimental or longitudinal designs to investigate STEM attitude and STEM career interest to set cause-effect relation. Second, the present study used only quantitative research methods to investigate low socioeconomic status students' STEM career interest. Future studies can investigate underlying reasons of low socioeconomic status students' career interest in detail by designing qualitative research. Additionally, the participants of this study were conveniently selected from rural areas of a small city and results cannot be generalized to all low socioeconomic status students in Turkey.

To sum up, as mentioned before, middle school years are important for students' interest. Thus to encourage students for choosing STEM related careers, the integration of STEM activities should be started at early levels. Besides that, according to the findings of this study, low socioeconomic status students have limited knowledge about career options. Hence, not only engaging students to STEM related activities, but also making them aware about different STEM careers may also excite their interest in STEM domains. Actually, STEM areas are popular among both students and parents in Turkey ("Career choice", 2013). However, this popularity may come from extrinsic factors like other significant people's desire, prestigious occupations, and financials reasons (Sarıkaya & Khorhid, 2009). However, it is important that students get aware of how science is useful in their life, how it is interesting and enjoyable. By integrating STEM activities into curriculum, the underlining reasons of students' STEM career aspiration may become intrinsic motivation rather than external reasons like social desirability. We think that integrating STEM activities into Turkish schools has potential to educate citizens who have internationally competitive; have 21st century skills and are scientifically literate.

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APPENDIX-1

Original and Turkish version of Semantic STEM survey for career interest

1. Original Semantic STEM survey for career interest (Tyler-Wood, et al., 2010, p. 350)

To me, a career in science, technology, engineering, or mathematics (is):									
1.	Means nothing	1	2	3	4	5	6	7	Means a lot
2.	Boring	1	2	3	4	5	6	7	Interesting
3.	Exciting	1	2	3	4	5	6	7	Unexciting
4.	Fascinating	1	2	3	4	5	6	7	Mundane
5.	Appealing	1	2	3	4	5	6	7	Unappealing

2. Turkish version of Semantic STEM survey for career interest

Fen, Teknoloji, Mühendislik veya Matematik alanında kariyer sahibi olmak ….									
1.	Hiçbir anlam ifade etmiyor	1	2	3	4	5	6	7	Çok şey ifade ediyor
2.	Sıkıcı	1	2	3	4	5	6	7	İlgi çekici
3.	Heyecan verici	1	2	3	4	5	6	7	Can sıkıcı
4.	Büyüleyici	1	2	3	4	5	6	7	Sıradan
5.	Çekici	1	2	3	4	5	6	7	Çekici değil

APPENDIX-2

Stem Career Interest Scale

Aşağıdaki meslek gruplarının ne derece ilginizi çektiğini işaretleyiniz.	Hiç ilgimi çekmiyor	İlgimi çekmiyor	İlgimi çekiyor	Çok ilgimi çekiyor
1. Fizik Bilimleri (astronot, atmosfer ve uzay bilimci, biyokimyacı/biyofizikçi, kimyager, çevrebilimci, yerbilimci, fizikçi)	1	2	3	4
2. Yaşam Bilimleri (tarım ve gıda bilimci, veteriner, biyolog, mikrobiyolog, eczacı, hemşire, tıp doktoru, diş doktoru, tıp ve laboratuvar teknisyeni)	1	2	3	4
3. Teknoloji (bilgisayar güvenlik uzmanı, bilgisayar ve iletişim sistemleri uzmanı, yazılım mühendisi, bilgisayar programcısı, veri tabanı uzmanı, grafiker)	1	2	3	4
4. Mühendislik (uzay mühendisi, mimar, biyomedikal mühendisi, kimya mühendisi, inşaat mühendisi, bilgisayar donanım mühendisi, elektrik mühendisi, endüstri mühendisi, makine mühendisi)	1	2	3	4
5. Matematik (matematikçi, muhasebeci, istatistikçi, maliye uzmanı)	1	2	3	4