Res Sci Educ (2020) 50:1217–1231
https://doi.org/10.1007/s11165-018-9729-4

Multivariate Assessment of Middle School Students' Interest in STEM Career: a Profile from Turkey

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Published online: 28 May 2018
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Abstract According to a report by the Turkish Industry and Business Association, Turkey will need approximately 1 million individuals to be employed in Science Technology Engineering Mathematics (STEM) fields by 2023, and 31% of this requirement will not be met. For continuous economic development, there is a need to integrate STEM into education in Turkey, which brings the need for research in this area. This study, based on a survey model, aimed to determine the level of interest of a sample of Turkish middle school students in STEM careers on the basis of gender, where they lived, grade levels, their end-of-semester grades, and their parents' educational status and levels of income. The research data was collected using the STEM Career Interest Survey (STEM-CIS) and Personal Information Form, which were applied to 851 middle school students (fifth and eighth graders). The collected data was analyzed with SPSS using Mann Whitney *U* and Kruskal Wallis *H* tests. It was found that middle school students' interest in STEM careers differed according to sex, where they lived, and grade levels but it did not differ in relation to their parents' educational status and the levels of income of the family. It is believed that the results obtained in this study reflecting the profile in Turkey will guide educational policy makers, curriculum developers, teachers, pre-service teachers, and researchers about STEM education.

Keywords STEM career interest · Middle school students · Demographic variables

STEM education can be defined as integrated learning-teaching process in the four specific disciplines of science, technology, engineering, and mathematics which are usually taught as separate subjects in different classes (Merrill 2009). Such education

The abstract of this study was presented at the 26th International Conference on Educational Sciences (ICES/UEBK-2017) between dates of 20-23 April 2017.

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enables students to apply their knowledge to real-life situations. STEM education contributes to students' problem solving and critical and analytical thinking skills, and also creates an authentic learning environment (Brown et al. 2011). STEM education has a positive impact on students, providing high motivation and positive attitudes, developing their technology literacy and upper order thinking skills, and increasing their science and mathematics achievement (Moore et al. 2013). In Turkey, a report on STEM education by the Turkish Ministry of Education (MoNE) emphasized that this types of education would increase the success of Turkey in international tests, such as PISA and TIMMS (MoNE 2016).

According to a report by the Turkish Industry and Business Association (TUSIAD), Turkey will need approximately 1 million individuals to be employed in STEM fields by 2023, and 31% of this requirement will not be met (TUSIAD 2017). To meet the need for STEM employment and ensure continuous economic development, there is a need to integrate STEM into the education system in Turkey. Research has shown that there is a correlation between the early career interest and career choice (Crisp et al. 2009); therefore, if elementary, middle, and/or high school students are involved in STEM activities through a STEM-based curriculum, it is quite likely that students' interest in a STEM career will increase (Bybee 2013). In the initial step in implementing STEM education, it is important to determine the level of students' interest in a STEM career, and the effects of variables on this interest level can give significant clues as to how to apply STEM in schools.

Review of Literature

Institutions operating in the field of educational sciences claim that specialization in STEM careers and interest in those careers should start in middle school (Kier et al. 2013). In middle school, children aged from about 11 to 14 start to explore and recognize careers that can be associated with their own interests and abilities (Super 1953). Research has also shown that students' choice of careers is shaped at the level of secondary school (Tai et al. 2006). Furthermore, some studies have found that being exposed to STEM enterprises and activities at early ages influences primary school students' perceptions and plans in this respect in positive ways (Dejarnette 2012).

The number of studies performed in STEM education is increasing including discussions on what STEM is, how it can be integrated into education (Breiner et al. 2012), and applications beginning in pre-school education (Sullivan and Bers 2016). The most outstanding issues in the literature are the effects of demographic variables, such as sex, factors related to school or environment/family on STEM fields or STEM careers (Brown et al. 2016; Chen and Simpson, 2015; Christensen et al. 2015; Christensen and Knezek 2017; Hughes 2013; Ing 2014; Kauffmann et al. 2009; Kimmel et al. 2012; Mbano and Nolan 2017; Nnachi and Okpube 2015; Olitsky 2014; You 2013). There are also various studies demonstrating that STEM applications positively influence students' cognitive and affective development (Becker and Park 2011; Hsu et al. 2017; McBride and Silverman 1991; Shahali et al. 2017; Stohlmann et al. 2013).

Social, motivational, and educational factors can be influential in choosing STEM education and careers in middle school (Nugent et al. 2015). Research conducted with university students found that girls thought that choosing STEM careers meant giving up the idea of marrying and starting a family. It was also reported that students considered

that a STEM career would affect their future work-life balance (Tan-Wilson and Stamp 2015). Another study adopting the perspective that women are not sufficiently represented in STEM demonstrated that there were psychosocial factors determining the gender biases in those fields. The study discussed the reasons for insufficient representation on the basis of sexual stereotypes, differences in spatial intelligence and hierarchical, regional discriminations, and discriminations in the share of labor. Social psychological interventions, role models, and self-affirmation strategies were analyzed in the study to promote the adequate representation of women in STEM fields (Nnachi and Okpube 2015). Influential in women's inadequate representation in this field are stereotypical beliefs; for example, concerning engineering, that it is a man's job, requires working outdoors, and is heavy (Capobianco et al. 2011; Fralick et al. 2009). Other research has also found that gender factor is influential in choosing engineering as a career (Kimmel et al. 2012). Eliminating or reducing the effects of those factors can also be possible with various applications. For instance, a study found that taking advanced level science course at high school reduced the effects of gender factor on choosing STEM careers and that it completely eliminated the effects of socio-economic level. The study, based on Social Cognitive Career Theory (SCCT), also found positive correlations between entering higher education, result expectations, and self-efficacy beliefs regardless of gender (Chachashvili-Bolotin et al. 2016). Another study, in which middle school students took part in STEM-related, real life-related, and applied curricula pointed out that students having positive interest in STEM would choose STEM careers. Accordingly, it was found that the majority of male students had positive interest in STEM and STEM careers. Female students, however, gave more positive responses to the project activities than the male students (Christensen and Knezek 2017). Focusing on high school students in the first year of the two-year science and mathematics academy program, a study found that the students had reduced inclinations towards STEM but their inclinations increased in the second year. The students' STEM inclinations differed according to gender in the first year, in which the boys had more interest in engineering and technology than the girls, but in the second year, girls had more interest in STEM careers (Christensen et al. 2015). Thus, teachers can be active in minimizing the differences in gender and group roles during the STEM activities in which students work in cooperatively (Brown et al. 2016).

A recent study conducted with students attending middle schools in rural Carolina in the USA reported that after-school activities undertaken in a STEM club positively contributed to the students' interest in STEM professions and field knowledge (Blanchard et al. 2017). However, there are only a limited number of studies concerning grade level and STEM studies. A study conducted in Turkey investigated whether secondary school students' interest in STEM careers differed according to grade levels found that their interest differed only on the sub-dimension of life sciences considering the sub-dimensions of physical sciences, life sciences, technology, and mathematics (Yerdelen et al. 2016).

Even though high levels of family income and educational status are thought to have positive effects on students choosing STEM careers (Chachashvili-Bolotin et al. 2016), there are findings that low socio-economic levels did not affect students' interest in STEM careers (George-Jackson and Lichtenberger 2012; Lichtenberger and George-Jackson 2013; Yerdelen et al. 2016). Parents with higher education levels tend to provide their children with informal science experience, which positively affects students'

interest in science (Dabney et al. 2016). In a study conducted with high school students, it was found that students' interest in science and their parents' professional occupations were associated with their science competencies (Chi et al. 2017). In addition, the results of PISA 2012 revealed that students whose parents had professional occupations were more successful in mathematics compared to other students (OECD 2014).

A study conducted in Turkey found that the interest of the middle school students of medium socio-economic level did not differ according to gender and grade levels. It was also found that both boys and girls had high interest in STEM careers. Researchers emphasized that middle school students in Turkey whose parents were at low socio-economic levels had limited knowledge in STEM careers and that they should be guided during secondary school education (Yerdelen et al. 2016).

Students' achievement in science and mathematics courses is also influential in their choice of STEM fields. For instance, in a longitudinal study, Ing (2014) found positive correlations between female (7th–12th graders) and male students' science and mathematics achievement and the permanence of achievement in STEM careers.

Concerning career choice, Holland's views are valuable, stating that the choice of occupations is influenced by the two important factors of personality and the environment. According to Holland's theory of typology, personality traits can be classified as realistic, researcher, artist, social, entrepreneur, and traditional, and individuals tend to attain achievement in jobs which are appropriate to the qualities they possess (Holland 1985). A study conducted according to Holland's personality typology and SCCT found that the types of personality were influential in choosing STEM careers. It was found that families' income levels and educational levels did not affect students' self-selection of STEM but gender, race/ethnicity, and achievement at high school were important determiners in STEM self-selection. It was also found that the probability of choosing to work in STEM fields was higher in individuals who had researcher personality but lower in individuals who had an artistic personality, and that men with strong social personality were less inclined to choose STEM fields but women with strong social personality were more positive in choosing STEM fields (Chen and Simpson, 2015).

Conceptual Framework

The conceptual framework of this study is based on Special Cognitive Theory (SCT), in keeping with other studies conducted in the field of STEM careers (Byars-Winston et al. 2010; Chachashvili-Bolotin et al. 2016; Chen and Simpson, 2015; Garriott et al. 2013; Kier et al. 2013; Nugent et al. 2015; Shin et al. 2017; Olitsky, 2014; Wang 2013). According to SCT, human behaviors interact with the individuals' cognitive, behavioral, and social environment (Bandura 1986). Self-efficacy, a concept highlighted in SCT, refers to an individual's awareness of his/her own knowledge, abilities, and capacity. An individual's belief in his/her abilities influences his/her performance in fulfilling a task. If a person's self-efficacy in an area is low, then his/her ability in that aspect is also low (Bandura 1977). Self-efficacy belief, which is influential in shaping individuals' behaviors, is based on four sources of interaction, namely direct experiences (achievement in performance/goals attained), indirect experiences (others' experiences), oral persuasion, and emotional state (Bandura 1994). Lent et al. (1994) suggested SCCT, which was developed on the basis of the following three basic concepts of SCT: self-efficacy

expectations, outcome expectations, and personal goals. These three variables are considered as the building blocks of career development and represent the key mechanisms that ensure personal control behaviors. The variables of this research were evaluated according SCCT as follows: the personal input was the gender variable, and the background/context consisted of SES and place of residence, and father and mother's educational level. These variables influence learning experiences, and thus the outcome expectation. Personal input and personal choices are also bidirectionally related. Personal choices guide interest, goals, and actions. Similarly, outcome expectations also have a bidirectional relationship with interest and have an impact on interest, goals, and actions. Self-efficacy and outcome expectation also affect the interest, goals, and acts of an individual (Kier et al. 2013; Lent 1994, 2000).

Aim of Study

The number of studies related to STEM education has considerably increased due to the importance attached to this topic in recent years. In Turkey, the subject of science and engineering applications was also added to the fourth-grade science curriculum implemented in the 2017–2018 academic year even though the change is not yet visible in curricula in Turkey. A report on STEM was also prepared by MoNE (2016), in which a model was recommended starting STEM education establishing centers for STEM education, undertaking research on STEM education, training teachers in accordance with the STEM education approach, updating curricula according to STEM, and providing course materials to create environments for STEM education in schools.

This study aimed to determine the interest of a group of middle school students in STEM careers according to certain demographic properties. In line with its purpose, this study sought answers to the following question: Do middle school students' STEM-CIS scores differ significantly according to demographic variables (gender, where they live, grade levels, end-of-semester grades, their mother and father's educational status, and their family's income level)?

Method

This is a quantitative research study employing a survey model. Survey models basically aim to describe the properties of a group, such as its capabilities, ideas, attitudes, beliefs, and levels of knowledge (Frankeal and Wallen 2003).

Study Group

This study consisted of 851 middle school students from 11 different provinces of Turkey. Convenience sampling method was used to determine the sample in this study. Table 1 shows the demographic distribution of students participating in the survey.

Since the research was performed at the level of middle school, grade levels were analyzed in four categories between fifth and sixth grades; gender was analyzed in two categories as girls and boys; end-of-semester grades were considered in five categories between one and five

Table 1 Demographic distribution of the students participating in the survey

Variables	Groups	*n*	Variables	Type of school	*n*
Sex	Girl	474	Educational status of mother	Primary school	274
	Boy	377		Secondary school	211
Place of residence	City center	493		High school	245
	District center	154		University	97
	Village	204		Other	24
Grade levels	5	64	Educational status of father	Primary school	168
	6	172		Secondary school	194
	7	429		High school	281
	8	186		University	187
End of semester grades	1	7		Other	21
	2	19	Family income level	750–1000TL	226
	3	114		1001–2000 TL	229
	4	289		2001–3000 TL	220
	5	422		3001–4000 TL	84
				4001 TL and above	92

from the lowest to the highest; parents' educational status was determined in five categories as primary school, secondary school, high school, university, and above; income level was allocated to five categories (750–1000 TL, 1001–2000 TL, 2001–3000 TL, 3001–4000 TL, and above); and the place of residence was analyzed in three categories as, city center, district center, and village.

The dependent variables in this study were interest in STEM fields and careers. These variables were also quantitative and continuous. Gender, place of residence, grade levels, end-of-semester grades, and father and mother's educational status were the independent variables, which were qualitative and discontinuous.

Data Collection Tools

Personal Information Form This form was prepared by the researchers to determine the demographic properties of the students' grade levels, sex, end-of-semester grades, family income levels, and place of residence.

STEM-CIS STEM-CIS was used in determining students' interest in STEM careers. It was developed by Kier et al. (2013) based on Bandura's social cognitive learning theory. The survey consists of 44 items and four sub-scales (science, technology, mathematics, and engineering) and was adapted into Turkish by Koyunlu Unlu et al. (2016). In the process of adaptation, analyses were performed for confirmatory factor analysis and test-retest reliability, calculations were undertaken for corrected item total correlations, and the significance of differences between the average scores for 27% bottom and top groups was analyzed through a *t* test. The Turkish version of the survey consisted of four sub-dimensions (science, technology, engineering, and mathematics) and 40 items. The measurement reliability was found to be 0.93 for STEM-CIS and 0.86, 0.88, 0.94, and 0.90 for the sub-dimensions of science, technology, engineering, and mathematics, respectively.

Data Collection Procedures

The provinces that researchers could easily reach were determined, and teachers working in the schools in those provinces were contacted and asked to give the integrated STEM-CIS and personal information forms to students. Assigned teachers instructed the students on how to complete the STEM-CIS and personal information form giving help when needed. The students were given the following instructions:

> Dear Students,
> This survey was prepared for evaluating your interest in careers in the fields of science, technology, engineering, and mathematics. First, please fill in the blanks in the personal information form using X. Then, read the sentences in the sections of SCIENCE, TECHNOLOGY, ENGINEERING, and MATHEMATICS, and mark your choice for each sentence: "I totally agree", "I agree", "I am undecided", and "I don't agree". Thank you for your participation.

Data Analysis

The data was analyzed on the Statistical Package for the Social Sciences (SPSS) v. 21. Serials average, one of approximate value assigning methods for lost data in SPSS, was employed. The value of .05 was considered as the significance level in interpreting the results. Firstly, incomplete data and normality (kurtosis and skewness, Kruskal Wallis Test) were examined and the data was organized. The data did not have a normal distribution according to the groups; therefore, non-parametric tests were used in the analysis of the data. Mann Whitney *U* test was used in analyzing the STEM-CIS scores according to gender. The Kruskal Wallis *H* test was used in testing whether there were any differences between STEM-CIS scores according to grade levels, end-of-semester grades, father and mother's educational status, family income levels, and place of residence.

Findings

Gender and STEM-CIS

Table 2 shows the Mann Whitney *U* test results for girls' and boys' science, technology, engineering and mathematics scores, and their STEM-CIS scores.

Table 2 shows that the students' scores for their interest in science careers differed in favor of the girls ($U = 76{,}777.50$, $p < .05$, $\eta^2 = 0.014$). Scores for the sub-dimensions of technology ($U = 70{,}220.00$, $p < .05$, $\eta^2 = 0.034$) and engineering ($U = 67{,}829.50$, $p < .05$, $\eta^2 = 0.043$), and total STEM-CIS scores ($U = 78{,}123.50$, $p < .05$, $\eta^2 = 0.011$) differed significantly in favor of boys. Yet, the participants' scores for mathematics careers did not differ significantly ($U = 87{,}781.50$, $p > .05$, $\eta^2 = 0.00$).

Table 2 Mann Whitney *U* test results for participants' STEM-CIS scores according to gender

Groups	Test statistics	S	T	E	M	Total
Girl	Mean rank	452.52	385.64	380.60	429.31	402.32
Boy		392.65	476.74	483.08	421.84	455.78
	U	76,777.50	70,220.00	67,829.50	87,781.50	78,123.50
	p	.00	.00	.00	.66	.00
	η^2	0.014	0.034	0.043	0.00	0.011

Table 3 Kruskal Wallis test results by place of residence

Groups	Test statistics	S	T	E	M	Total
City center	Mean rank	384.22	418.92	410.32	423.54	401.73
District center		456.54	426.35	454.32	428.08	448.85
Village		503.91	442.85	442.52	430.37	467.40
	χ^2	37.184	1.372	4.983	0.125	11.927
	p	.00	0.5	0.83	0.93	.00
	η^2	0.043	0.001	0.0058	0.00	0.014

Place of Residence and STEM-CIS

Table 3 shows the results of Kruskal Wallis test for the participants' science, technology, engineering, and mathematics scores and their STEM-CIS scores according to whether they lived in the city center, district center, or in a village.

As shown in Table 3, interest in science careers ($\chi^2 = 37.184$, $p < .05$, $\eta^2 = 0.043$) and total STEM-CIS scores ($\chi^2 = 11.927$, $p < .05$, $\eta^2 = 0.014$) differed according to living in the center of a province, in the center of a district, or in a village. The results of the Mann Whitney *U* test showed that students attending school in a village or a district had more interest in science and STEM-CIS careers than those enrolled in a school in a city center. Table 3 shows that the participants' interest in careers in technology ($\chi^2 = 1.372$, $p > .05$, $\eta^2 = 0.001$), engineering ($\chi^2 = 4.983$, $p > .05$, $\eta^2 = 0.0058$), and mathematics ($\chi^2 = 0.125$, $p > .05$, $\eta^2 = 0.00$) did not differ according to the place in which they lived.

Grade Levels and STEM-CIS

Table 4 shows the results of Kruskal Wallis test for the fifth, sixth, seventh, and eighth graders' science, technology, engineering, and mathematics scores, and their STEM-CIS scores.

Table 4 The results of Kruskal Wallis test for STEM-CIS scores according to the participants' grade levels

Groups	Test statistics	S	T	E	M	Total
5	Mean rank	552.05	497.68	493.10	549.00	551.61
6		498.12	457.31	467.98	456.29	490.17
7		390.23	405.00	407.44	441.66	406.84
8		398.45	420.82	406.90	319.55	367.62
	χ^2	43.140	11.488	13.381	55.374	41.543
	p	.00	.00	.00	.00	.00
	η^2	0.05	0.013	0.015	0.065	0.048

Table 4 reveals that the students' interest in science ($\chi^2 = 43.140$, $p < .05$, $\eta^2 = 0.05$), technology ($\chi^2 = 11.488$, $p < .05$, $\eta^2 = 0.003$), engineering ($\chi^2 = 13.381$, $p < .05$, $\eta^2 = 0.015$), and mathematics ($\chi^2 = 55.374$, $p < .05$, $\eta^2 = 0.065$) careers, and in STEM careers ($\chi^2 = 41.543$, $p < .05$, $\eta^2 = 0.048$) differed according to grade levels. This shows that the fifth and sixth graders' interest in science careers was higher than that of the seventh graders, and the sixth graders' interest was higher than that of the eighth graders. The fifth graders' interest scores for technology careers was higher than those of the seventh and eighth graders, and the sixth graders' scores were higher than those of the seventh graders. In terms of the engineering and total scores, the fifth and sixth graders had higher scores than the grade levels. Students' interest in mathematics careers was higher in the fifth grade than in the sixth and eighth grades, and their interest was higher in the sixth grade than in the seventh and eighth grades.

End-of-Semester Grades and STEM-CIS

Table 5 shows the results of Kruskal Wallis test for the participants' science, technology, engineering, and mathematics scores, and their STEM-CIS scores according to their end-of-semester grades.

As summarized in Table 5, students' interest in mathematics ($\chi^2 = 71.414$, $p < .05$, $\eta^2 = 0.084$), and STEM ($\chi^2 = 27.177$, $p < .05$, $\eta^2 = 0.031$) careers differed according to their end-of-semester grades. The results of the Mann Whitney *U* test performed with rank averages between paired groups revealed that successful students with an end-of-semester grade of 5 had higher interest in science, mathematics, and STEM careers than those with grades of 3 and 4. An examination of Table 5 clearly shows that interest in technology ($\chi^2 = 4.583$, $p > .05$,

Table 5 The results of Kruskal Wallis test for the participants' STEM-CIS scores according to their end-of-semester grades

Groups	Test statistics	S	T	E	M	Total
1	Mean rank	336.71	491.21	256.14	255.07	275.07
2		273.11	318.74	385.08	281.24	301.24
3		362.20	430.72	401.26	321.26	367.50
4		393.98	420.52	438.16	382.70	403.58
5		473.53	432.23	429.02	493.30	465.28
	χ^2	36.709	4.583	5.806	71.414	27.177
	p	.00	.33	.21	.00	.00
	η^2	0.043	0.005	0.0068	0.084	0.031

Table 6 The results of Kruskal Wallis test for the participants' STEM-CIS scores according to their mother's educational status

Type of school	Test statistics	S	T	E	M	Total
Primary school	Mean rank	417.30	403.72	398.98	395.25	393.44
Secondary school		458.30	444.91	442.08	441.21	457.49
High school		429.96	428.01	443.03	448.55	438.04
University		377.36	422.21	439.21	429.93	421.77
Other		397.54	508.79	365.85	397.29	415.13
	χ^2	8.185	6.284	7.120	7.524	8.935
	p	.085	.17	.13	.11	.063
	η^2	0.009	0.007	0.008	0.008	0.01

$\eta^2 = 0.005$) and engineering ($\chi^2 = 5.806$, $p > .05$, $\eta^2 = 0.0068$) careers did not differ according to end-of-semester grades.

Educational Status of Mother and the STEM-CIS Scores

Table 6 shows the results of Kruskal Wallis test for the participants' science, technology, engineering, and mathematics scores, and their STEM-CIS scores according to their mother's educational status.

As shown in Table 6, the students' scores for science ($\chi^2 = 8.185$, $p > .05$, $\eta^2 = 0.009$), technology ($\chi^2 = 6.284$, $p > .05$, $\eta^2 = 0.007$) engineering ($\chi^2 = 7.120$, $p > .05$, $\eta^2 = 0.008$), mathematics ($\chi^2 = 7.524$, $p > .05$, $\eta^2 = 0.008$), and STEM ($\chi^2 = 8.935$, $p > .05$, $\eta^2 = 0.01$) careers did not differ according to their mother's educational status. Thus, the level of the mother's education did not affect students' interest in STEM careers.

Educational Status of Father and STEM-CIS

Table 7 shows the results of Kruskal Wallis test for the participants' science, technology, engineering, and mathematics scores, and their STEM-CIS scores according to their father's educational status.

Table 7 shows that students' scores for science ($\chi^2 = 9.459$, $p > .05$, $\eta^2 = 0.011$), technology ($\chi^2 = 3.126$, $p > .05$, $\eta^2 = 0.003$), engineering ($\chi^2 = 4.911$, $p > .05$, $\eta^2 = 0.005$), mathematics ($\chi^2 = 4.042$, $p > .05$, $\eta^2 = 0.004$), and STEM ($\chi^2 = 3.338$, $p > .05$, $\eta^2 = 0.003$) careers did not

Table 7 The results of Kruskal Wallis test for the participants' STEM-CIS scores according to their father's educational status

Type of school	Test statistics	S	T	E	M	Total
Primary school	Mean rank	432.06	426.30	423.44	407.51	420.17
Secondary school		466.86	400.65	404.89	428.89	429.06
High school		407.09	431.96	427.65	420.21	416.91
University		414.97	439.78	453.85	453.09	448.49
Other		351.31	455.36	371.33	383.50	365.71
	χ^2	9.459	3.126	4.911	4.042	3.338
	p	.05	.53	.29	.4	.5
	η^2	0.011	0.003	0.005	0.004	0.003

Table 8 The results of Kruskal Wallis test for the participants' STEM-CIS scores according to their family income level

Income groups	Test statistics	S	T	E	M	Total
750–1000	Mean rank	440.73	419.92	424.87	390.57	421.28
1001–2000		411.81	407.67	406.71	440.42	411.54
2001–3000		437.52	432.89	417.12	427.37	422.04
3001–4000		402.40	443.01	438.90	449.01	443.48
4001–abv.		419.13	454.57	486.22	452.86	467.10
	χ^2	2.910	3.240	7.470	7.339	3.930
	p	.57	0.51	.11	.11	.41
	η^2	0.003	0.003	0.008	0.008	0.004

differ according to their father's educational status; thus, the father's education level did not affect their children's interest in STEM careers.

Family Income Level and STEM-CIS

Table 8 shows the results of the Kruskal Wallis test for the participants' science, technology, engineering, and mathematics scores and their STEM-CIS scores according to the level of family income.

As revealed by Table 8, students' interest in science ($\chi^2 = 2.910$, $p > .05$, $\eta^2 = 0.003$), technology ($\chi^2 = 3.240$, $p > .05$, $\eta^2 = 0.003$, engineering ($\chi^2 = 7.470$, $p > .05$, $\eta^2 = 0.008$), mathematics ($\chi^2 = 7.339$, $p > .05$, $\eta^2 = 0.008$), and STEM ($\chi^2 = 3.930$, $p > .05$, $\eta^2 = 0.004$) careers did not differ according to their family income level, showing that this variable did not influence their interest in STEM careers.

Conclusion and Discussion

This study found that students' interest in STEM careers differed according to gender, place of residence, family's economic level, and grade levels, but it did not significantly change according to their father and mother's educational status or family income level.

The findings obtained in this study demonstrated that girls had more interest in science careers than the boys; however, boys had more interest in technology, engineering and STEM careers than the girls. No differences were found between boys' and girls' interest scores for mathematics careers. The results obtained in this study were similar to those obtained in a recent study, which revealed that boys attending secondary school had more interest in STEM careers and fields than girls (Christensen and Knezek 2017). Sexual stereotyping is influential on students' choice of a career (Evans and Diekman 2009), and this can be seen in the lower number of women in STEM careers. Shapiro and Sax (2011) also pointed out that families could have positive and negative contributions to girls' potential involvement in STEM careers. If there are any members of the family working in the field of STEM, they can serve as role models to girls and support them in choosing a STEM career. However, in a family holding stereotypical beliefs about STEM careers, those beliefs can have negative effects on the girls choosing STEM careers. The attitude and behaviors arising from those stereotypes can be countered as revealed in a study showing that female students who initially had lower disposition towards STEM careers than male students had higher disposition than male students after receiving training (Christensen et al. 2015).

This study showed that students' interest in science, mathematics, and STEM careers differed according to grade levels. Students at lower grade levels had more interest in science, mathematics, and STEM careers. This was probably because of the gradual change in interest according to age, especially during adolescence (Anderman and Maehr 1994). However, interest in technology and engineering careers did not differ according to grade levels. Based on these results, it can be stated that interest scores for science and mathematics careers affect the overall scores for STEM careers in positive ways. A study investigating whether secondary school students' interest in STEM careers differed according to grade levels found that their interest differed only on life sciences, not on the other sub-dimensions of physical sciences, technology, and mathematics (Yerdelen et al. 2016).

It was also found in this study that students' interest in science, mathematics, and STEM careers differed according to their end-of-semester grades. Accordingly, students with a high level of achievement had more interest in science, mathematics, and STEM careers than those with a medium level of achievement. Thus, it can be stated that interest scores for science and mathematics influence the total scores for STEM careers. On the other hand, interest in technology and engineering careers did not differ in relation to grade scores. In a similar vein, Ing (2014) also found that achievement in science and mathematics affected students' decision to choose STEM careers. Female students' achievement in secondary and high school science and mathematics courses has important influences on their choice of STEM careers at university (Shapiro and Sax 2011). Blickenstaff (2005) attributed women's inadequate representation in the fields of STEM to their low academic achievement in science and to their low attitudes at childhood.

Several factors influencing students' self-selection of STEM include gender, race/ethnicity, achievement, socio-economic level, and personality type (Chachashvili et al. 2016; Chen and Simpson, 2015). However, research conducted with university students found that variables, such as race/ethnicity, socio-economic status, and academic achievement at high school were not sufficiently influential in students' selection of STEM careers. Hence, it was found that individuals having the characteristics of a researcher, i.e., individuals who think in analytical ways, have developed internal perspective, focus on tasks, have critical attitudes, or are logical, prudent, curious, passive, humble, reserved, intellectual, or independent, were more likely to choose STEM careers. It was also found that individuals having a bias towards art, e.g., those who are complicated, irregular, or emotional, do not obey rules, are esthetic and sensitive, and express themselves in art, and entrepreneurs that are leaders and dominant, can obtain what they want, are adventurous, ambitious, always ready to discuss and be visible, and are active, energetic, self-confident, and talkative, did not choose STEM careers (Chen and Simpson, 2015).

Another finding from this study was that the educational status of the students' father and mother did not affect their disposition towards STEM careers. Ing (2014) states that family support in relation to STEM careers affects students' achievement and their choice of careers. Teachers and families are also considerably influential in students' selection of STEM careers. Furthermore, families have dominant roles in children's choice of careers (Trusty, 1996) and need to understand the quality and potential of STEM careers (Kauffmann et al. 2009). There are studies in the literature claiming that families with high levels of education and having high income are influential factors in the permanence in STEM fields (Gayles and Ampaw 2011). According to Social Cognitive Learning Theory, high educational level and high income are also influential in the choice of careers. Activities performed within the family increase children's knowledge and skills (Lent et al. 1994). Families' awareness about STEM careers and their conscious efforts to increase their children's interest and skills in STEM fields have a higher influence on their children's choice of career than their socio-economic level. The current study also found that families' socio-economic levels did not influence middle school students' interest in STEM careers, and this is supported in the literature (Chen and Simpson 2015; George-Jackson and Lichtenberger 2012; Lichtenberger and George-Jackson 2013). Chachashvili et al. (2016) believe that this situation stems from STEM careers bringing higher income than other careers. Another finding obtained in this study parallel to this belief was that students living in a village or district had more interest in STEM careers.

According to SCCT, personal input and background/context influence learning experiences, and thus outcome expectation. Self-efficacy and outcome expectation also affect the interest, goals, and acts of an individual (Lent 1994, 2000). However, while some results of this study were consistent with SCCT, others were in conflict with it. For example, the findings showing that the girls' mean score for interest in technology, engineering, and total STEM was at a low level, supporting SCCT. On the other hand, other variables, namely the place of residence, the family economic level, and the students' grades were found to be incompatible with SCCT.

Limitations and Suggestions for Future Studies

This study had limitations in terms of the data collection tools and the number of samples. Furthermore, conducting research on a quantitative basis does not provide in-depth data; nevertheless, the results of this study present an outline of the issues related to the choice of STEM careers. Qualitative studies can be performed in the future to obtain detailed results, and because there are a great number of studies on gender and STEM, researchers can focus on other variables (such as the place of residence, grade levels, and father and mother's levels of education). The results of this study are considered to guide educational policy makers, curriculum developers, teachers, prospective teachers, and researchers. In further work, SCT and STEM career choice will be evaluated qualitatively.

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