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THE RELATIONSHIP BETWEEN MIDDLE SCHOOL STUDENTS' LEVELS OF 21ST CENTURY LEARNING SKILLS AND THEIR INTEREST IN STEM CAREER

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Abstract: This study aims to examine the relationship between 21st century learning skills of middle school students' and their interest in career in STEM fields. In the study, single survey, causal-comparative and correlational survey research models are used. The study group of the research consists of 228 students studying at the sixth, seventh and eighth grade in a public middle school. In this research, 21st Century Learning Skills Inventory and STEM Career Interest Survey (STEM-CIS) are used as data collection tools. In the analysis of quantitative data, descriptive statistical techniques, independent samples t-test, one-way variance (ANOVA) analysis, and Pearson moments multiplication correlation coefficient are used. Discoveries of this study point out that 21st century learning skills of middle school students and levels of interest towards career in STEM fields of these students are above the average. According to the gender variable, while there was no significant difference among 21st century learning skills, there was a significant difference in terms of technology among interest in the career in STEM fields. In terms of class level, the significant difference regarding active learning, learning to learn, and problem solving is between sixth and eighth grade students, and it is in favor of the sixth grade students. Among the interest in career in STEM fields, the significant difference regarding science, mathematics, and technology is between sixth and eighth grade students, and it is in favor of the sixth grade students. On the other hand, middle and low-level positive and meaningful relations have been found between the 21st century learning skills of middle school students and their interest in career in STEM fields. Consequently, some suggestions were made in the light of the findings.

Key words: 21st century learning skills, middle school, interest in STEM career

1. Introduction

In our current age of knowledge and informatics, in other words, information besides new social transformation there are also changes in economical, political and cultural fields (Göker, 2001). Especially the increase of scientific activity, the rapid rise of technology, growth of access to information possibilities and change of needs brings new roles to individuals of the current age, which features individual differences. In this manner, both social expectations have been differentiated and individual skills such as problem-solving, creativity, analytical thinking, ratiocination, flexibility, adaptability and communication referred to as 21st century skills, have standed out (National Research Council [NRC], 2011). The overall approach, proved by the studies on 21st century skills, underlines that individuals need to gain skills such as high-level thinking, creativity, innovativeness, information and communication technology (Bozkurt & Çakır, 2016). As a matter of fact, as an important study and a way of practice with STEM education, which includes science, mathematics, technology, and engineering the significance of these skills increased. STEM approach, instead of teaching science, mathematics, technology, and engineering separately, aims at a more qualified education perceptive by establishing an effective connection between these disciplines (Kennedy & Odell, 2014). STEM leads to a transformation towards multidisciplinary education rather than addressing these disciplines separately (Riechert & Post 2010). In addition to these, to ensure that individuals know different interdisciplinary approaches closely and to increase the tendency towards professions based on these disciplines are among the basic approaches of STEM education (Dabney et al., 2012; Carnevale, Smith, & Melton, 2011).

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Countries' desire to have a say in the globalizing world and the expectation of over achievement has increased the need for STEM education (Kennedy & Odell, 2014). This approach is seen as an important one that improves 21st century skills such as active learning, critical thinking, learning to learn, problem solving, creativity, all round-thinking, collaboration, and communication (Yıldırım & Selvi, 2015). STEM education supports students to have self-confidence, to look at incidents from a different point of view, to become skillful by human experience, to be effective problem solvers, and to have flexible ability sensations (Carnevale et al., 2011; Corlu, Capraro, & Capraro, 2014; Wai, Lubinski, Benbow, & Steiger, 2010). In other words, STEM contains information, skill, and beliefs that connect subject fields (Corlu et al., 2014). Students, aware of this education, not only solve the problems that they face in daily life but also do the planning and make evaluations (Aydın, Saka, & Guzey, 2017). STEM aspire to create a solution to real-life problems by using the engineering approaches, mathematical analysis technics, and technology (Yıldırım, Başaran, Cücük, & Yokuş, 2018). In fact, in the STEM education report published by the National Research Council, it is stated that to improve STEM literacy, to increase the participation into STEM career, and to support career developments in STEM fields rank among the basic goals of STEM (NAE & NRC, 2014). Also, the scientific process, reasoning, overarching, communication, reflective, and questioning thinking skills are shown among the other basic goals that STEM tries to bring in to students (Corlu et al., 2014). These goals, also, are constituted of a wide range field that includes 21st century learning skills. The main purpose here is to provide each student to have skills such as access to entrepreneurship, information, orientation, communication, leadership, reasoning, curiosity, and imagination (Wagner, 2010). STEM education aims at bringing students different aspects and interdisciplinary understanding instead of one point of view (Karakaya, Avgın, & Yılmaz, 2018). Also, it is quite significant for STEM education that individuals learn by doing, living, experiencing (Altunel, 2018).

STEM education found responses in many countries in a short period, at the same time there are studies, researches, and projects that conducted on the subject in our country. As a matter of fact, in the STEM education report published by the Ministry of National Education, it is stated that curriculums need to be updated as including STEM education in order to enhance the interest of our students, that studies about the subject need to be conducted (MoNE, 2016). Accordingly in the studies that made in our country, mostly, manner towards STEM education (Aydın et al., 2017; Yolagiden & Bektaş, 2018), STEM practices (Çakır & Ozan, 2018; Daymaz, 2019; Karadeniz, 2019; Kurt, 2019; Şanlı, 2019; Uçar, 2019), interest in STEM career (Azgın & Şenler, 2019; Badur, 2018; Balçın, Çavuş, & Topaloğlu, 2018; Karakaya et al., 2018; Uğraş, 2019; Ürünibrahimoğlu, 2019; Yerdelen, Kahraman, & Taş, 2016), the relationship of STEM events with factors such as success, problem solving, motivation, and thinking skills (Çakır & Ozan, 2018; Öner, 2019), scale developments towards STEM (Koyunlu Ünlü, Dökme, & Ünlü, 2016; Özcan & Koca, 2019; Yıldırım & Selvi, 2015), and 21st century learning sufficiency (Bozkurt & Çakır, 2016; Gülen, 2013; Önür, 2018) are approached. Either in our country or the international field, studies that conducted emphasize that STEM education is quite important for students (Aydın et al., 2017; Christensen & Knezek, 2017; Corlu et al., 2014; Wyss, Huelskamp, & Siebert, 2012). Because they are in a period that interest in professions is intense and career planning is taking place, it is a crucial time for middle school students to develop manner and interest towards STEM (Balçın et al., 2018; Gottfredson, 2002). While the importance of STEM education for students is obvious, it is stated that middle school students' awareness is limited so there is a need to conduct more studies about STEM (Kennedy & Odell, 2014; MoNE, 2016; Uğraş, 2019; Wai et al., 2010). In fact, according to Blotnicky, Franz-Odendaal, French and Joy (2018) middle school students have limited STEM career information about the subject necessities and about what kind of activities that careers contain.

In the body of literature, when studies about 21st century learning skills and interest in STEM career are examined in general, it is seen that middle school students' 21st century learning skills and interest in STEM career are mostly positive and on a good level (Balçın et al., 2018; Bozkurt & Çakır, 2016; Gülen, 2013; Karakaş, 2015; Yerdelen et al., 2016). When studies analyzed in the context of the gender factor, various types of results draw attention. For example, some studies show that the gender variable does not affect the interest in STEM careers (Balçın et al., 2018; Yerdelen et al., 2016; Yolagiden & Bektaş, 2018), while some studies show that female students have better 21st century skills than male students (Bozkurt & Çakır, 2016). And some other studies show that male students are

more interested in STEM careers than female students (Christensen & Knezek, 2017). In addition to these, there are also studies that show a significant difference in the dimension of mathematics and technology (Karakaya et al., 2018; Ürünibrahimoğlu, 2019), female students are more interested in science and mathematics career whereas male students are more interested in engineering and technology (Badur, 2018; Uğraş, 2019), that female students' cognitive, affective, and socio-cultural levels are higher than the male students (Karakaş, 2015). When the studies in the body of literature are considered in the context of class level, it draws attention that as the class level rises the interest of students in STEM career decreases (Badur, 2018; Balçın et al., 2018; Bozkurt & Çakır, 2016; Uğraş, 2019; Yolagiden & Bektaş, 2018). On the other hand, although it is possible to encounter in studies that science and mathematic dimensions change significantly due to class level (Karakaya et al., 2018; Ürünibrahimoğlu, 2019), actually there is not a meaningful variation due to class level (Yerdelen et al., 2016).

Without any doubt, in today's society of information, the most valuable investment is enabling the productive use of knowledge and allowing acquisition of new knowledge. To raise decent literate individuals conveying knowledge directly is not enough. In this respect, STEM, on the strength of its authenticity and the professions that it contains, is pretty valuable in terms of providing the progress of society, maintaining economic welfare, keeping pace with the fast moving technology, and the rivalry with other nations (Koyunlu Ünlü & Dökme, 2018; Maltese & Tai, 2010; Yolagiden & Bektaş, 2018). Especially, to enhance the competitive power in the international field, STEM education approach has strategic importance (Corlu et al., 2014). Nowadays, the tendency towards STEM education is increased, it is evident that there is a need, more than ever, to do researches and studies about STEM. Because of students' interest in STEM career, 21st century learning skills have an impact on STEM labor productivity. When this is taken into consideration, the importance of studies in this aspect is understood much better (Christensen & Knezek, 2017). In this sense, it is anticipated that the study conducted would create resources for both program creators and researchers. In fact, according to Wyss et al., (2012) in order to increase the number of students that will proceed to STEM education and career, at first we should increase the awareness of students about the STEM career. Likewise, Owen and Çapan (2017) emphasize that, one of the main reasons for students to choose natural sciences and engineering is the interest towards these disciplines. In light of all these statements, the aim of creating an interest in STEM career and awareness towards 21st century learning skills for middle school students, reveals the value and necessity of the study.

1. 1. Aim of the Study

This study aims to analyze the relationship between 21st century learning skills of middle school students and their interest in STEM career.

1. 2. Questions of the Study

- What is the level of the 21st century learning skills of middle school students?
- Do the 21st century learning skills of middle school students differ due to gender?
- Do the 21st century learning skills of middle school students differ due to class level?
- What is the level of interest of middle school students towards STEM career?
- Does the interest of middle school students towards STEM career differ due to gender?
- Does the interest of middle school students towards STEM career differ due to class level?
- Is there a relationship between 21st century learning skills of middle school students and their interest in STEM career?

2. Methodology

2. 1. Research Model

In the study, the quantitative research approach is adopted, single survey, casual-comparative, correlational survey models are appointed together. To determine the 21st century learning skills of students and levels of their interest in STEM career, the single survey model is used. The single survey model is research to determine the formation of factors one by one or as an amount (Karasar, 2013).

Students' 21st century learning skills and interest in STEM career whether or not they differ due to independent factors (e.g. gender, class level) is analyzed by the casual-comparative model. The casual-comparative model aims to determine the cause and effect of differences between cohorts without any interference to conditions and attendants (Büyüköztürk et al., 2014). The correlational survey model is used to determine the relationship between 21st century learning skills of students and their interest in STEM career. The correlational survey model aims to determine the existence or dimension of change between two or more factors and at the same time foretell (Fraenkel, Wallen, & Hyun, 2012).

2. 2. Participants

The population of the research is composed of students on the sixth, seventh, eighth grade of middle school from a province in Aegean region, the sample is constituted of 228 students that can be reached by using the proper method of sampling while the restrictions of time, money, and labor loss are considered. Non-random, proper, sampling method is preferred in the creation of the study group. In this method, if a certain region is out of the question, voluntary individuals take part who are close by, approachable, and willing to participate in the research (Erkuş, 2011). Therefore, in the creation of this study group an approachable and at the same time economical process is pursued. 34.2% (*N*=78) of students are sixth graders, 26.3% (*N*=60) of them are seventh graders and 39.5% (*N*=90) of them are eighth-graders; 52.6% (*N*=120) of students are female, 47.4% (*N*=108) of them are male.

2. 3. Data Collection Tool

To determine the 21st century learning skills of students, the 21st Century Learning Skills Inventory, of which reliability and validity are tested by Gülen (2013), is used. There are 8 items in the dimension of active learning, 13 items in the dimension of learning to learn, 6 items in the dimension of problem solving, and 6 items in the dimension of collaboration and communication of the four-factor inventory. The Cronbach's alpha internal consistency parameter of the inventory is calculated as, respectively, 0.82 for the dimension of active learning, 0.87 for the dimension of learning to learn, 0.74 for the dimension of problem solving, 0.83 for the dimension of collaboration and communication. Within the context of the study, the internal consistency parameters of the dimensions of inventory are calculated as well. According to this, it is calculated as 0.81 for the dimension of active learning, 0.89 for the dimension of learning to learn, 0.83 for the dimension of problem solving, 0.80 for the dimension of collaboration and communication. Examples of the inventory are presented down below:

- I make presentations about different subjects in lessons.
- I check the accuracy of my lecture notes from other resources.
- Mostly, I generate creative and effective solutions to solve my problems.
- I work with my friends while preparing my project papers.

In order to determine the interest of the students towards STEM career, the Interest Scale for Career in STEM fields (STEM-CIS) based on the social cognitive learning theory of Bandura by Kier, Blanchard, Osborne, and Albert (2014). The Turkish adaptation of the scale is made by Koyunlu Ünlü, Dökme, and Ünlü (2016). There are ten items on each dimension of the scale which is consist of 4 dimension (science, mathematic, technology, and engineering). The total Cronbach's alpha internal consistency parameter of the scale is determined as 0.93. The internal consistency parameters of the dimension are calculated as, respectively, 0.86 for the dimension of science, 0.90 for the dimension of mathematic, 0.88 for the dimension of technology, 0.94 for the dimension of engineering. Within the context of the study, the internal consistency parameters of the dimension of the scale are also calculated. It is calculated as 0.84 for the dimension of science, 0.89 for the dimension of mathematic, 0.86 for the dimension of technology, 0.88 for the dimension of engineering. In the scale, the five Likert type of rating system is used in a way that absolutely agree → not agree. Examples of the scale are presented down below:

- I want to have a job related to science.
- I work harder for math lesson than others.
- I love to use technology intraclass studies.
- I am interested in professions related to engineering.

2. 4. Data Analysis

In the research, besides descriptive statistical techniques, independent samples t-test, one-way variance (ANOVA) analysis, and Pearson moments multiplication correlation coefficient are used. In this direction, primarily, the analysis of normality related to the 21st Century Learning Skills Inventory and the Interest Scale towards Career in STEM fields is practiced. Skewness value of dimensions related to survey tools changes between -0.85 and -0.33, as for kurtosis value of dimensions related to survey tools, it changes between 1.36 and -0.42. It is considered as proof of the existence of normal distribution that these parameters' are within the boundaries of ±2 and close to 0 (Tabachnick & Fidell, 2013). Because the dataset shows a normal distribution, parametric tests are used. On the other hand, because the data has a normal distribution in each group and variations acquired from the groups are equal to each other ($p>0.05$) one-way variance (ANOVA) analysis is used. In consequence of ANOVA, in order to determine the significant difference is between which groups, from multiple comparison tests, the Bonferroni test is used. In all analyses, the significance level is determined as 0.05. The relationship between 21st century learning skills and interest in STEM career is examined by the Pearson moments multiplication correlation test. If the Pearson moments correlation parameter, as an absolute value, is between 0.70-1.00 it is identified as a high relationship, if it is between 0.70-0.30 it is identified as a middle relationship, if it is between 0.30-0.00 it is identified as a low relationship (Büyüköztürk, 2005). In the analysis of the data, SPSS 22.0 program is used.

3. Results

In this section, the 21st century learning skills of the students included in the research and their interest levels in STEM career are approached due to gender and class level factors. Besides, the relationship between middle school students' 21st century learning skills and interest in career in STEM fields is analyzed. What is the level of the 21st century learning skills of middle school students? The results of this question are listed down below.

Table 1. *Descriptive values about 21st century learning skills levels of middle school students*

Dimension	*N*	Min.	Max.	Average	Median	Mod	Std.	Total
Active learning	228	1.38	5.00	3.61	3.62	3.88	0.75	823.63
Learning to learn	228	1.31	5.00	3.73	3.76	4.15	0.77	852.23
Problem solving	228	1.00	5.00	3.70	3.66	3.67	0.88	843.83
Collaboration and Communication	228	1.00	5.00	3.54	3.66	3.83	0.90	807.33

When table 1 is examined, from the 21st century learning skills of middle school students, the highest average value is from the dimension of learning to learn (X=3.73), the lowest average value is from the dimension of collaboration and communication (X=3.54). On the other hand, when the values of active learning (X=3.61), and problem solving (X=3.70) are taken into consideration, it can be said that the 21st century learning skills of students are above the average. Do the 21st century learning skills of middle school students differ due to gender? The results of this question are listed down below.

Table 2. *Independent samples t-test, results of 21st century learning skills of middle school students due to gender*

Dimension	Gender	*N*	$\bar{X}$	Std.	Sd.	t	*p*
Active learning	Female	120	3.64	0.71	226	0.63	0.08
	Male	108	3.57	0.79			
Learning to learn	Female	120	3.85	0.71	226	2.36	0.06
	Male	108	3.61	0.81			
Problem solving	Female	120	3.80	0.83	226	1.96	0.40
	Male	108	3.58	0.92			
Collaboration and Communication	Female	120	3.60	0.91	226	1.15	0.61
	Male	108	3.46	0.89			

$p<0.05$ level of significance

When table 2 is examined each of the active learning, learning to learn, problem solving, collaboration and communication, composing the 21st century learning skills, is not demonstrate a significant difference due to gender factor (p>0.05). Do the 21st century learning skills of middle school students differ due to class level? The results of this question are listed down below.

Table 3. *ANOVA results of 21st century learning skills of middle school students due to class level*

Dimension	Resource of Variance	Sum of Squares	Sd.	Mean Squares	F	*p*	Significant Difference
Active learning	Between groups	9.97	2	4.98	9.42	0.00*	6>8
	Within groups	119.00	225	0.52			
	Total	128.97	227				
Learning to learn	Between groups	4.29	2	2.14	3.68	0.02*	6>8
	Within groups	130.91	225	0.58			
	Total	135.20	227				
Problem solving	Between groups	6.75	2	3.37	4.44	0.01*	6>8
	Within groups	170.67	225	0.75			
	Total	177.42	227				
Collaboration and Communication	Between groups	0.97	2	0.48	0.58	0.55	-
	Within groups	186.03	225	0.82			
	Total	187.00	227				

*p<0.05

According to table 3, active learning ($F_{(2,225)}$=9.42; p<0.05), learning to learn ($F_{(2,225)}$=3.68; p<0.05), and problem solving ($F_{(2,225)}$=4.44; p<0.05), composing the 21st century learning skills of middle school students, demonstrate significant difference due to class level. But, collaboration and communication ($F_{(2,225)}$=0.58; p>0.05) do not demonstrate significant difference. In consequence of ANOVA, in order to identify the source of the difference in the dimension of active learning, learning to learn, and problem solving, the Bonferroni test is used. The significant differences are between the sixth and eighth graders and are on behalf of sixth graders. What is the level of interest of middle school students towards STEM career? The results of this question are listed down below.

Table 4. *Descriptive details of middle school students interest in STEM career*

Dimension	N	Min.	Max.	Average	Median	Mod	Std.	Total
Science	228	1.30	5.00	3.93	4.00	3.70	0.69	898.10
Mathematics	228	1.00	5.00	3.65	3.80	3.30	0.93	833.10
Technology	228	1.00	5.00	3.80	3.80	4.40	0.78	868.00
Engineering	228	1.00	5.00	3.47	3.47	3.00	0.82	791.20

When table 4 is examined, from middle school students' interest in career in STEM fields, the highest average value is from the dimension of science (X=3.93), the lowest average level is from the dimension of engineering (X=3.47). Besides, when the values from the dimension of mathematics (X=3.65), and the dimension of technology (X=3.80) are taken into consideration, students' interest in career in STEM fields is below the average. Does the interest of middle school students towards STEM career differ due to gender? The results of this question are listed down below.

Table 5. *Independent samples t-test, result of students interest in STEM career due to gender*

Dimension	Gender	*N*	$\bar{X}$	Std.	Sd.	t	*p*
Science	Female	120	3.96	0.65	226	0.62	0.36
	Male	108	3.90	0.75			
Mathematics	Female	120	3.73	0.87	226	1.30	0.13
	Male	108	3.56	0.98			
Technology	Female	120	3.90	0.64	226	1.90	0.00*
	Male	108	3.70	0.90			
Engineering	Female	120	3.41	0.80	226	-1.10	0.86
	Male	108	3.53	0.84			

When table 5 is examined, from the interest in career in STEM fields, the dimension of technology demonstrates a significant difference due to gender. When the average values are taken into consideration, female students' (X=3.90) average value in the dimension of technology is found much more than the male students (X=3.70). On the other hand, the dimension of science, mathematics, and engineering do not demonstrate a significant difference due to gender ($p>0.05$). Does the interest of middle school students towards STEM career differ due to class level? The results of this question are listed down below.

Table 6. *ANOVA results of middle school students interest in STEM career due to class level*

Dimension	Resource of Variance	Sum of Squares	Sd.	Mean Squares	F	*p*	Significant Difference
Science	Between groups	4.99	2	2.49	5.29	0.00*	6>8
	Within groups	105.93	225	0.47			
	Total	110.92	227				
Mathematics	Between groups	20.90	2	10.45	13.33	0.00*	6>8
	Within groups	176.30	225	0.78			
	Total	197.20	227				
Technology	Between groups	4.33	2	2.16	3.63	0.02*	6>8
	Within groups	134.15	225	0.59			
	Total	138.48	227				
Engineering	Between groups	3.08	2	1.54	2.27	0.10	-
	Within groups	152.59	225	0.67			
	Total	155.67	227				

When table 6 is examined, the dimensions of science ($F_{(2,225)}=5.29$; $p<0.05$), mathematics ($F_{(2,225)}=13.33$; $p<0.05$), and technology ($F_{(2,225)}=3.63$; $p<0.05$), composing the middle school students' interest in career in STEM fields, demonstrate significant difference due to class level. On the other hand, the dimension of engineering ($F_{(2,225)}=2.27$; $p>0.05$), do not demonstrate a significant difference. In the consequence of ANOVA, in order to identify the source of the significant difference in the dimensions of science, mathematics, and technology Bonferroni test is used. Results of this test show that the significant difference in the dimensions of science, mathematics, and technology is between the sixth and eighth graders and on behalf of sixth graders. Is there a relationship between 21st century learning skills of middle school students and their interest in STEM career? The results of this question are listed down below.

Table 7. *Relationship between the levels of 21st century learning skills of middle school students and their interest in STEM career*

Variables		V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8
V_1	r	1.00	0.82*	0.62*	0.53*	0.62*	0.56*	0.32*	0.34*
	p	.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V_2	r		1.00	0.71*	0.52*	0.55*	0.57*	0.38*	0.35*
	p		.	0.00	0.00	0.00	0.00	0.00	0.00
V_3	r			1.00	0.47*	0.43*	0.47*	0.38*	0.38*
	p			.	0.00	0.00	0.00	0.00	0.00
V_4	r				1.00	0.39*	0.34*	0.36*	0.28*
	p				.	0.00	0.00	0.00	0.00
V_5	r					1.00	0.52*	0.25*	0.36*
	p					.	0.00	0.00	0.00
V_6	r						1.00	0.20*	0.30*
	p						.	0.00	0.00
V_7	r							1.00	0.45*
	p							.	0.00
V_8	r								1.00
	p								.

V=Variable, V_1=Active Learnig, V_2=Learning to Learn, V_3=Problem Solving, V_4=Collaboration and Communication, V_5=Science, V_6=Mathematics, V_7=Technology, V_8=Engineering

To determine whether or not there is a statistical relationship between the 21st century learning skills of middle school students and their interest in career in STEM fields, Pearson moments multiplication correlation parameters are looked at. When table 7 is examined, it is discovered that there is a statistical relationship between the 21st century learning skills of middle school students and their interest in career in STEM fields. The highest relationship is between science and active learning ($r=0.62$; $p<0.05$) and it is on the average level, whereas the lowest relationship is between engineering, and collaboration and communication ($r=0.28$; $p<0.05$) and it is on the lowest level. Besides, it is discovered that there is a meaningful and average level positive relationship between science and learning to learn ($r=0.55$; $p<0.05$), problem solving ($r=0.43$; $p<0.05$), collaboration and communication ($r=0.39$; $p<0.05$). Similarly, it is discovered that there is a meaningful and average level positive relationship between mathematics and active learning ($r=0.56$; $p<0.05$), learning to learn ($r=0.57$; $p<0.05$), problem solving ($r=0.47$; $p<0.05$), collaboration and communication ($r=0.34$; $p<0.05$). It is found that there is a meaningful and average level positive relationship between technology and active learning ($r=0.32$; $p<0.05$), learning to learn ($r=0.38$; $p<0.05$), problem solving ($r=0.38$; $p<0.05$), collaboration and communication ($r=0.36$; $p<0.05$). It is found that there is a meaningful and average level positive relationship between engineering and active learning ($r=0.34$; $p<0.05$), learning to learn ($r=0.35$; $p<0.05$), and problem solving ($r=0.38$; $p<0.05$). According to results, it is seen that the more 21st century learning skills of students are increased the more interested they are in career in STEM fields.

4. Conclusions and Discussion

In the study, the relationship between middle school students' 21st century learning skills and interest in career in STEM fields is analyzed. In this direction, primarily the levels of 21st century learning skills of students and their interest in career in STEM fields are determined. Regarding the results, it is discovered that active learning, learning to learn, problem solving, collaboration and communication which compose the 21st century learning skills of students, are above the average. Similarly, it is discovered that, from their interest in career in STEM fields, science, mathematics, technology, engineering are also above the average. According to these discoveries, 21st century learning skills of middle school students and their interest in career in STEM fields are in a positive direction. At the same time, these discoveries coincide with similar study results in the body of literature (Balçın et al., 2018; Bozkurt & Çakır, 2016; Christensen & Knezek, 2017; Gülen, 2013; Karakaş, 2015; Karakaya et al., 2018; Önür, 2018; Yerdelen et al., 2016). In light of these discoveries, it can be said that, in general, 21st century learning skills of middle school students and their interest in career in STEM fields are at a good level. In other words, students are using 21st century learning skills adequately, and at the same time have sufficient interest in career in STEM fields. Students' adequate use of 21st century learning skills shows that they are decent active learners which means they do not have any problem with access to information, have skills of collaboration and communication, and can solve problems. The reason for this situation is, nowadays, individuals do not have much trouble with access to information and learning materials. In fact, Karakaş (2015) states that in order to be sure that they get information and information variety, students analyze, interpret, and structure different aspects. On the other hand, while there are multiple reasons for students' interest in career in STEM fields being above the average, in today's society the increase of activities and popularity of these activities, which includes science, mathematics, technology, engineering, are among the main reasons. According to Yolagiden and Bektaş (2018), science, mathematics, technology, engineering are lead key elements that affecting the daily life of today's society. Thus, it is inevitable for students to have an interest in these fields. This situation is stated as 'to have a high interest in these fields during middle school is a significant factor for individuals to gravitate towards STEM careers during University education' by Dabney and other, (2012). In this regard, societies must form curriculums and conduct necessary infrastructure works by taking students' 21st century learning skills and interest in career in STEM fields into consideration. Altunel (2018) points out this situation and states that the 21st century is an era that production, education, and human resource became prominent and recruitment of global competitiveness, development, and prosperity is hinged upon this. In this sense, to increase the STEM events in schools contributes to both individuals' 21st century learning skills and awareness in STEM.

In this respect, teachers need to productively use the positive perception of students towards these fields and concentrate on using 21st century learning skills more for their educational content.

Another discovery acquired from the research is that 21st century learning skills do not differ due to gender. Hence, the gender factor does not have a significant impact on 21st century learning skills. Yet, when the body of literature was analyzed we encounter with the result that the level of 21st century learning skills of female students is higher (Bozkurt & Çakır, 2016). Different socio-economic levels of students, diversity of samples or ages of students can be demonstrated as the cause of this situation. On the other hand, when the students' interest in career in STEM fields is analyzed according to gender factor, it is discovered that in the dimension of technology there is a significant difference in favor of female students, while there is not a significant difference in the dimensions of science, mathematics, engineering. As the reason for this situation, female students might have better technological opportunities and develop themselves better. In addition to these, teachers who benefit more from technological opportunities in their lessons might affect students' interests. When similar studies about students' interest in career in STEM fields is analyzed within the context of gender factor, it attracts attention that there are different results. For example, it is possible to come across study results such as the level of interest in career in STEM fields does not differ due to gender factor (Balçın et al., 2018; Yerdelen et al., 2016; Yolagiden & Bektaş, 2018), male students are more interested in the dimensions of science, mathematics, and technology (Ürünibrahimoğlu, 2019), male students are more interested than the female ones (Christensen & Knezek, 2017), female students are more interested in career of science and mathematics, whereas male students are more interested in career of engineering and technology (Uğraş, 2019), there is not a significant difference in the dimensions of technology and engineering due to gender factor (Karakaya et al., 2018), and female students are more interested in science career (Badur, 2018). Hence, 21st century learning skills of students and their interest in career in STEM fields might differ due to gender factor. Many other factors might affect this situation as well. But it should not be neglected that students must be equipped with 21st century learning skills and in order to spread STEM education, which serves to this purpose, to large masses equally and effectively, an awareness in students need to be created (MoNE, 2016). Like many other institutions in service of education indicates, students' interest in career in STEM fields should start during middle school and their tendency should be used effectively (Kier et al., 2014). Because, it is known that students' career choice and perception of science substantially starts during middle school (Wyss et al., 2012).

One of the remarkable discoveries of the research is that the 21st century learning skills of middle school students differ due to class level. Accordingly, active learning, learning to learn, and problem solving skills of sixth graders have shown a difference in favor of sixth graders. So, it can be said that the younger age group is better at 21st century learning skills. Similarly, Bozkurt and Çakır (2016) state that as the class level of middle school students increases the 21st century learning skills decrease. On the other hand, it is discovered that interest in career in STEM differs due to class level. Accordingly, middle school students' interest in career in STEM fields, in the dimensions of science, mathematics, and technology, differs in favor of sixth graders. Also, acquired discovery coincides with the other similar study results in the body of literature (Badur, 2018; Balçın et al., 2018; Uğraş, 2019; Yolagiden & Bektaş, 2018). But in the related body of literature, due to class factor, it is possible to encounter with the study results stating that students' feelings about having a STEM career do not differ (Yerdelen et al., 2016). In this direction, it can be said that conducting activities towards STEM education generates more effective results in the younger age group of students. In fact, it is known that individuals, who have positive experiences about STEM subjects at early ages, are more interested in career in STEM fields (Wai et al., 2010). Aydın et al., (2017) draw attention to this situation and indicate that students' interest in science, mathematic, technology, and engineering fields at an early age and their attendance to STEM practices is higher than the older ones. In this respect, if teachers give a place to STEM activities in their lectures and conduct effective counseling activities for their students, it might impact students' interest in science in a positive way. The discoveries acquired from this study reveals that starting the STEM education at an early age is quite important. Because students' interest in career in STEM fields decreases as they get older (Balçın et al., 2018). Students who have positive experiences about STEM subjects at an early age are more interested in STEM careers in the future (Maltese & Tai, 2010).

Another discovery acquired from the study is obtained from the relationship between 21st century learning skills of middle school students and their interest in career in STEM fields. Accordingly, middle and low-level positive significant relationships between the 21st century learning skills of middle school students and their interest in STEM career have been discovered. While the highest relationship is between active learning and science, the lowest is between engineering and collaboration and communication. The remarkable point is all the dimensions, which compose the 21st century learning skills of middle school students and their interest in career in STEM fields, exhibit a significant relationship in a positive direction. This finding coincides with the expressions, which frequently mentioned in the body of literature, stating that in the process of raising individuals who carry the necessary 21st century learning skills an education approach and philosophy based on certain foundations, undoubtedly, occupy a significant place (MoNE, 2016; NAE & NRC, 2014). As is known in the STEM education approach it is aimed at students to take responsibility for their daily life problems and to use the life and engineering design skills to solve these problems, and to develop their entrepreneurship skills (NRC, 2011; Uğraş, 2019). Thus, students need to have 21st century qualifications in order to comply with changes, to choose correct and also useful information within the pile of information, to follow developments closely, to adopt a productive consciousness, and most importantly to adjust these pieces of information into daily life. Findings of this study, also, show that students' 21st century learning skills are related to STEM and these skills affect the interest in career in STEM fields. In this sense, to generalize STEM education centers, to give more place to activities about STEM in curriculums, and to inform teachers about STEM education is quite important for students to use their 21st century learning skills more effectively. In fact, as frequently mentioned it is needed to popularize the STEM approach which highlights the sense of wonder of individuals and helps turn the learned information into a product with genuine ideas.

Consequently, in terms of the process of life long learning 21st century student characteristics are pretty significant (NRC, 2011). Especially, together with today's developing technology focusing on the top-end mental process and life skills for the students of the new millennium is inevitable. The main reason for this situation is rather than students' use of learned information or skill as it is, the need for mental processes such as creative thinking, problem solving, decision making in real life or situations similar to real life. In fact, the STEM approach aiming at developing multidisciplinary thinking abilities offers important opportunities for societies. It is evident that we need, more than ever, an education approach like STEM which uses 21st century learning skills of students and allows students to develop themselves coordinately in multiple fields. As a consequence, to create awareness for students and to concentrate more on studies, researches are needed. Through this study, because it aims at creating more resources for the body of literature and awareness in students, it is expected that it would make significant contributions to similar studies. Besides these expressions, the study has certain restrictions. One of the important restrictions of the study is that the study is conducted with quantitative data. In this respect, longitudinal studies supported by qualitative data can be exercised. Also, with a larger sample group content of the study can be extended. Another restriction of the study is that it is conducted with voluntary students. Accordingly, the interest of students in career in STEM fields and the 21st century learning skills of students who did not want to participate in the study might show differences. On the other hand, middle school students are included in this study. Similar studies including different types of grade levels might be conducted.

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