Journal of Human Sciences
ISSN: 2458-9489
Volume: 13 Issue: 3 Year: 2016

Effect of demographic features to middle school students' attitude towards FeTeMM (STEM)

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Abstract
In this research, which is done in order to determine the demographical features on middle school students' 6th, 7th and 8th grades towards FeTeMM (STEM), scanning design is used. It is performed with 581 middle school students, and data are collected through Middle School Students' point of view to Stem (S-Stem) scale. The research is implemented during 2015-2016 spring period. For statistical evaluation of gathered data, independent t-test and one direction variance analysis (anova), one direction variance analysis Kruskal-Wallis are used. Also, data are evaluated on 0.05 level relevance and its percentage, frequency, average and standard deviation levels are calculated. According to findings gathered from the study, it is seen that opinion of students to FeTeMM (STEM), the mother education level and father education level have a great effect but gender and class level haven't. On the other hand, applied sciences, like maths, engineering and 21st century skills, the effects of students' gender, mom and father education level and grade level are expressed.

Keywords: FeTeMM; FeTeMM Education; STEM; Attitude.

1. Introduction:

The rapid development of science and technology has increased the importance of qualified trained manpower in different areas. This situation brought the idea of raising productive and questioning individuals. Educators are using different approaches and education programs during learning and teaching processes. Newest example of this is the education and practice of FeTeMM. FeTeMM, as the science, technology, maths and engineering information and skills focuses on engineering design, is the education approach that aims to make learners gain the problem solving skills through using their research, producing and creativity, teach them interdisciplinary cooperation, to be open to communication, to have ethical values (Buyruk & Kormaz, 2016, 62; Bybee, 2010b, 996; Dugger, 2010; Rogers & Porstmore, 2004, 16).

FeTeMM education is the system in which a relation between science, technology, engineering and maths disciplines are formed and the integration between these disciplines is formed (Akgündüz, Ertepınar, Ger, Kaplan Sayı & Türk, 2015b, 10; Bybee, 2010, 996). The past of FeteMM education belongs to 1990s (Bybee, 2010, 996). FeTeMM education aims to establish an interdisciplinary relation and to handle learning in a whole approach (Smith & Karr-Kidwell, 2000, 1). On FeTeMM

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education, the effort is for having an integration of science, maths, technology and engineering disciplines and establishing a relation between confronted problem and content (Yamak, Bulut & Dündar, 2014, 251). As the integration on FeTeMM education can be in a form that having these four disciplines suitable to each other, and also having one discipline to center and other is considered a context for teaching the content that is determined by the central discipline (Yamak & et al., 2014, 251; Moore, Stohlmann, Wang, Tank, & Roehrig, 2013). FeTeMM education focuses on considering the disciplines together for research, designing, problem solving, cooperation and effective communication skills, which are planned to be taught to learners, rather than considering included different disciplines one by one (Buyruk, et al., 2016, 62). FeTeMM education aims to make learners gain the skills to consider the problems from an interdisciplinary view through different point of views rather than only one frame. 21st century skills, which will increase students' interest and tendency towards science, technology, engineering and maths disciplines (Baran, Canbazoglu-Bilici & Mesutoglu, 2015, 2).

Information and technology's harmonical development lead to an increase on human population and the emerge of new news. Solution of such problems for a country and to keep up with other knowledge – technological improvements can be possible with innovation (Buyruk, et al., 2016, 62). In order a country to become a leader for scientific area and improve economically, one of the significant items is to place FeTeMM education to education system (Lacey & Wright, 2009, 83). In order countries to be rivals on international area, the strategical significance of FeTeMM education is so huge (Corlu, Capraro & Capraro, 2014, 74). On today's world, if its considered that countries express their superiority with being a technological and scientific leader, it cannot be ignored to increase the number of working human beings, who gets qualitative education in the area of FeTeMM, So, in order to raise a generation that has the innovation capability, the content, theory and pratical usage of FeTeMM education should be researched on school level (Corlu, Adıgüzel, Ayar, Corlu & Ozel, 2012, 683). The ones that support FeTeMM (STEM) education on primary school level mentions that it will increase the knowledge that learners have on areas of problems that is related with all the world, talent and problem solving skills and it will be effective on the change on numbers of students that plans to have a career on these areas (Honey, Pearson & Schweingruber, 2014, 22).

When it was revealed the country's 2023 vision and strategic objectives are considered to determine the Ministry of Education in our country, science-technology-engineering and mathematics (STEM fields) must be defined in the country of training (Corlu, et al., 2012, 683 However, studies in this field is still in the initial levels (Çavaş, Bulut, Holbrook & Rannikmae, 2013, 21; Corlu, et al., 2012, 683; Marulcu & Sungur, 2012, 22).

When the international literature is analyzed, it is seen that there are (Rehmat,2015; Saad, 2014; Unfried, Faber & Wiebe, 2014; Naizer, Hawthorne & Hanley, 2014; Tseng, Chang & Lou, 2013; Moore, Stohlmann, Wang, Tank & Roehrig, 2013; Doppelt, Mehalik, Schunn, Silk & Krysinski, 2008; Wells, Sanchez, & Attridge, 2007 Fortus & ark., 2004) lots of studies. For example, as a result of the summer camp program that Nazier & et al. (2014) done with middle school learners, they determined that students' interest rises in terms of maths and science and technology. Rehmat (2015), on his study, determined that the interest of students that are on experiment group of STEM activities based on a problem. On their performed study, Doppelt & et al. (2008) mentioned that FeTeMM education to high level and low level students created an increase on information level.

When the studies that are done in Turkey are analyzed, it is seen that there are scale studies related with FeTeMM education (Hacıömeroglu & Bulut, 2016; Buyruk & et al., 2016; Gülhan & Sahin, 2016; Yıldırım & Selvi, 2015). It is seen that there are integration and operation of activities studies

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related with FeTeMM education (Yıldırım & Selvi, 2016; Corlu & Aydın, 2016; Gencer, 2015; Yıldırım & Altun, 2015; Sahin, Ayar & Adıgüzel, 2014; Yamak & et al., 2014; Ercan & Sahin, 2013)

Through the analysis of literature, it's seen that there is no research related with demographic features on 6th,7th and 8th grade students' point of views about FeTeMM (STEM). In order to fill in a blank on the literature, it is aimed to find out about the demographic features' effects on 6th, 7th and 8th grade students. When it's analyzed from this view, this research is thought to have a contribution to literature in order to determine the factors that affect the attitude towards FeTeMM.

1.1. The aim of the Research

On this research, it's aimed to determine the effects of demographical features of 6th, 7th, 8th graders' point of views on FeTeMM (STEM). For the purpose of research, it is on the problem "Does the point of views of middle school 6th, 7th, 8th grade students towards change according to independent variables?"
In the frame of the determined problem, answers to questions are searched:

- Does the point of views of middle school 6th, 7th and 8th grade students show difference according to gender?
- Does the point of views of middle school 6th, 7th and 8th grade students show difference according to grade level?
- Does the point of views of middle school 6th, 7th and 8th grade students show difference according to mother education level?
- Does the point of views of middle school 6th, 7th and 8th grade students show difference according to father education level?

2. Method

On this research, scanning design, which is one of the quantitative research methods, is used. Scanning method is the numerical (qualitative) description of the environment's attitude, tendency and point of view as a result of the analysis performed on samples that are chosen from the environment of the research (Bursal, 2014, 155).

2.1. Study Group

The environment of study consists 581; 6th, 7th and 8th grade middle school students that live in Kahramanmaras city. From the environment of the research, they are chosen with the suitable sample method. Suitable sample method is the sampling method that hinders the loss of factors like time, working power and money. The study was implemented during 2015-2016 spring period. The demographical information distribution of the students that attended to the research is given on table 1.

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Table 1. The demographical information distribution of the students that attended to the research

		f	%
Gender	Female	307	52.8
	Male	274	47.2
Class	6^{th}	163	28.1
	7^{th}	236	40.6
	8^{th}	182	31.3
Mother Education Level	Primary	245	42.2
	Middle	152	26.2
	High School	111	19.1
	University	62	10.7
	Master's Degree	11	1.9
Father Education Level	Primary	125	21.5
	Middle	135	23.2
	High School	142	24.4
	University	141	24.3
	High School	38	6.5
All		581	100.0

When data from Table 1 is analyzed, it is seen that 28% of the research sample (n=163) is 6th grade, 40.6% (n=236) is 7th grade and 31.3% (n=182) is 8th grade middle school students. 52.8% (n=307) of these learners are female and 47.2% (n=274) of them are male.

2.2. Data Collection Tool

Scientific research, which can be expressed as gathering scientific information process, is a systematical process that consist steps or activities following each other (Büyüköztürk, 2009, 6). For gathering demographical information of students attending to the research, "Personal Information Questionnaire", for which two (2) experts share, their opinion and Likert formed "Middle School Learners' Attitude towards STEM" scale, whose variability and reliability studies are done by Yıldırım and Selvi (2015). It is generated by Faber et al. (2012). The selections and points on the positive items of the scale with 5-point Likert scale are organized as; 5= Agree Strongly, 4= agree, 3= neutral, 2= agree less, 1= strongly disagree. Negative sentences on the scale are graded oppositely as strongly disagree 5 and strongly agree 1. Scale is consisted of four (4) factors as Maths-Science-Engineering and Technology and 21st Century Skills. The Cronbach's alpha values of factors are changing between 0.86 and 0.89, corrected items all point correlations change between 0.38 and 0.78. (Yıldırım & Selvi, 2015, 1119). The cronbach's alpha values of the scale and its sub dimensions are given on table 2.

Table 2. Attitude towards STEM scale and sub dimensions reliability values

Test Sub Dimensions	Reliability Values
Maths	.873
Science	.863
Engineering	.872
21th Century Skills	.915
All	.928

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When table 2 is analyzed, it is observed that the security reliability is high due to the gathered Cronbach's alpha factor (.927) as the result of the research.

2.3. Data Analysis

In the context of the research, gathered data from middle school learners (6th, 7th and 8th grade) are analyzed with the help of IBM SPSS-21 statistics program. On the statistical evaluation of gathered values from this study, individual t-test and one-way variance analysis (Anova), one direction Kruskal-Wallis variance analysis is used. On the other hand, data is evaluated with 0.05 reliability level and percentage, frequency, average and standard deviation values are also given.

3. Findings

On this section, data gathered from the analysis of middle school students' attitudes towards FeTeMM (STEM) through various variables. Minimum, Maximum, Average and Standard Deviation Levels that belong to used scale and its sub dimensions is presented on table 3.

Table 3. Values about STEM Attitude Scale and its Sub Dimensions

Test Sub Dimensions	N	Min	Max	$\bar{X}$	SD
Maths	581	1.00	5.00	3.55	0.88
Science		1.22	5.00	3.69	0.76
Engineering		1.00	5.00	3.55	0.84
21st century skills		0.00	5.00	3.88	0.81
Scale	581	1.43	4.92	3.68	0.61

On this study, the effects of gender, family education level, the grade level to FeTeMM is analyzed. Firstly, an answer for question "Does the point of views of middle school 6th, 7th and 8th grade students show difference according to gender?" and gathered independent t-test results are given on table 4.

Table 4. T-test analysis results according to gender

Test Sub Dimensions	Gender	N	$\bar{X}$	Sd	t	p
Maths	Female	307	3.62	579	1.907	0.057
	Male	274	3.48			
Science	Female	307	3.76	579	2.207	0.028*
	Male	274	3.62			
Engineering	Female	307	3.54	579	-.388	0.698
	Male	274	3.56			
21st Century Skills	Female	307	3.91	579	1.110	0.267
	Male	274	3.84			
All	Female	307	3.72	579	1.579	0.115
	Male	274	3.64			

*p<0.05

When data on table 4 is analyzed, it is expressed that there is no meaningful difference for middle school (6th, 7th and 8th grade) attitude according to the gender variable. (p> 0.05) Yet, it is observed that there is a meaningful difference for middle school learners attitude towards science according to gender (t (579) = 2.207; p < 0.05). When the science average points according to gender are analyzed, it can be mentioned that female learners have got a higher attitude for science.

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An answer to question "Does the point of views of research sample middle school 6th, 7th and 8th grade students show difference according to mother education level?" is searched and frequency, average, standard deviation and one direction variation analysis (Anova) is performed. The results are presented on table 5 and 6.

Table 5. Frequency, standard points and standard deviation values according to mother education level

Education Level		Maths		Science		Engineering		21st Century Skills	
	N	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Primary (1)	244	3.40	0.86	3.64	0.75	3.61	0.84	3.81	0.84
Middle (2)	152	3.46	0.82	3.63	0.75	3.49	0.89	3.74	0.89
High School (3)	110	3.77	0.89	3.73	0.79	3.48	0.81	4.08	0.66
University (4)	63	3.97	0.85	3.93	0.69	3.64	0.80	4.07	0.72
Master Degree (5)	12	3.66	1.11	3.92	0.80	3.41	0.91	4.09	0.39
All	581	3.55	0.88	3.69	0.76	3.55	0.84	3.88	0.81

Table 6. One direction variance analysis (anova) results according to mother education level

Sub Dimensions		Square All	sd	Square Average	F	p	Reliability (Tukey)
Maths	Between Groups	23.313	4	5.828	7.811	.000*	3-1, 3-2 4-1, 4-2
	In Group	429.786	576	.746			
	All	453.098	580				
Science	Between Groups	5.698	4	1.425	2.470	.044*	4-1
	In Group	332.180	576	.577			
	All	337.878	580				
Engineering	Between Groups	2.680	4	.670	.931	.446	-
	In Group	414.718	576	.720			
	All	417.398	580				
21st Century Skills	Between Groups	11.405	4	2.851	4.350	.002*	3-1, 3-2 4-2
	In Group	377.503	576	.655			
	All	388.908	580				
All	Between Groups	6.426	4	1.607	4.410	.002*	4-1, 4-2
	In Group	209.840	576	.364			
	All	216.266	580				

*p<0.05

When the data on table 6 is analyzed, according to mother education level, there is a meaningful difference on scale's maths [F (4,576) =7.811; p<0.05], science [F (4,576) =2.470; p<0.05] and 21st century skills [F (4,576) =4.350; p<0.05] dimensions. According to performed Tukey test, when compared with others, students with a university graduated mother has got a positive meaningfulness on p< 0.05 level for the "Maths, Science and 21st Century Skills" dimensions of the scale.

An answer to question "Does the point of views of research sample middle school 6th, 7th and 8th grade students show difference according to father education level?" is searched and frequency, average, standard deviation and one direction variation analysis (Anova) is performed. The results are presented on table 7 and 8.

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Table 7. Frequency, average point and standard deviation values according to father education level

Education Level	N	Maths		Science		Engineering		21.century talents	
		$\bar{X}$	SS	$\bar{X}$	SS	$\bar{X}$	SS	$\bar{X}$	SS
Primary (1)	126	3.32	0.82	3.64	0.78	3.65	0.83	3.86	0.81
Secondary (2)	135	3.38	0.86	3.62	0.74	3.48	0.89	3.74	0.92
High School (3)	142	3.54	0.89	3.63	0.81	3.56	0.87	3.82	0.84
University (4)	140	3.81	0.83	3.82	0.68	3.48	0.76	3.99	0.68
Master Degree (5)	38	4.03	0.89	3.88	0.75	3.68	0.85	4.23	0.64
All	581	3.55	0.88	3.69	0.76	3.55	0.84	3.88	0.81

Table 8. One direction variance analysis (anova) results according to father education level

Sub Dimensions of Test		Square All	Sd	Standard Average	F	p	Reliability (Tukey)
Maths	Between Groups	28.475	4	7.119	9.657	.000*	4-1, 4-2, 5-1,5-2, 5-3
	In Group	424.624	576	.737			
	All	453.098	580				
Science	Between Groups	5.194	4	1.298	2.248	.063	-
	In Group	332.684	576	.578			
	All	337.878	580				
Engineering	Between Groups	3.364	4	.841	1.170	.323	-
	In Group	414.034	576	.719			
	All	417.398	580				
21.Century Talents	Between Groups	9.561	4	2.390	3.629	.006*	5-2
	In Group	379.347	576	.659			
	All	388.908	580				
All	Between Groups	6.686	4	1.671	4.594	.001*	4-2, 5-1 5-2, 5-3
	In Group	209.580	576	.364			
	All	216.266	580				

*p<0.05

When data on table 8 is analyzed, it can be seen that there is a meaningfulness on levels Maths [F(4,576)=9.657; p< 0.05] and 21st century skills [F(4,576)=3.629); p< 0.05] according to the father education level of learners that attended to the research. According to the Tukey test results, having a "master's degree graduate or university graduate" father creates a positive meaningfulness for "Maths and 21st century skills" on level p< 0.05 when compared with other students.

An answer to question "Does the point of views of research sample middle 6th, 7th and 8th grade students show difference according to grade level?" is searched and frequency, average, standard deviation and one direction variation analysis Kruskal - Wallis is performed. The results are presented on table 9 and 10.

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Table 9. Frequency, average point and standard deviation values according to grade level

Sub Dimensions	Grade Levels	N	$\bar{X}$	SS
Maths	6th grade	163	3.76	0.79
	7th grade	236	3.60	0.83
	8th grade	182	3.55	0.97
Science	6th grade	163	3.71	0.73
	7th grade	236	3.70	0.75
	8th grade	182	3.66	0.80
Engineering	6th grade	163	3.48	0.82
	7th grade	236	3.61	0.86
	8th grade	182	3.54	0.85
21st Century Talents	6th grade	163	3.80	0.93
	7th grade	236	3.96	0.78
	8th grade	182	3.85	0.73
All		581	3.68	0.61

Table 10. One direction kruskal-wallis variance analysis results according to grade level

		N	Line Aver.	Sd	X^2	p
Maths	6th grade	163	327.52	2	18.551	0.00*
	7th grade	236	296.88			
	8th grade	182	250.66			
Science	6th grade	163	287.77	2	.259	0.878
	7th grade	236	295.27			
	8th grade	182	288.35			
Engineering	6th grade	163	272.78	2	3.381	0.184
	7th grade	236	304.16			
	8th grade	182	290.25			
21st Century Talents	6th grade	163	279.68	2	5.043	0.080
	7th grade	236	309.84			
	8th grade	182	276.71			
All		581			5.357	0.069

*p<0.05

When data on table 10 is analyzed, it is seen that there is p< 0.05 level meaningful on the Maths dimension of the scale according to the class level of the students that attended to the research. When the Maths average is analyzed, it is clear that 6th grade students have got a higher attitude when compared with other class students.

4. Discussion and Results

On this research in which the effect of demographical features on middle school 6th, 7th, or 8th grader learners' attitude towards FeTeMM (STEM), Attitude for STEM scale is used. When the studies in literature are examined, it is understood that effect of demographical features (gender, grade level, mother education and father education level) on middle school 6th, 7th, or 8th grader students' attitude towards FeTeMM (STEM) is not studied enough. So, it is thought that the results of this study will have a significant contribution on literature about the subject.

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It is seen that only the points on scale's science level have got a statistical meaningfulness between them for male and female students. According to that result, it can be expressed that gender can be counted as a factor that has an effect on scale's science dimension. When the scale and its other dimensions' averages are analyzed, it is observed that female students' is higher than male students. Although this situation does not create a statistical meaning, it can be said that female students have a higher attitude for FeTeMM (STEM). Yet, this result shows difference with the research result of Unfried & et al. (2014); Wells, Sanchez & Attridge (2007).

It is seen that there is a statistical meaningfulness between the points that students, who attended to the research, got from science, maths and 21st century skills and on general of scale that is prepared according to mother education level. On science level, a meaningful is clear between students with university graduate mothers and the ones with primary school graduate mothers. On maths and 21st century skills dimensions, there is meaningfulness between the points those students with high school and university graduate mothers and students with primary school and middle school graduate mothers. On scale dimension about middle school students' FeTeMM (STEM) attitudes, there is meaningfulness between students with university graduate and the ones with primary school and middle school graduate mothers. According to these results, it can be said that mother education level for 6th, 7th and 8th grade students is factor that affects their attitude towards FeTeMM (STEM).

It is seen that there is a statistical meaningfulness between points that students of the research gather from the sub dimension of scale maths, 21st century skills and the general scale itself according to father education levels. On maths dimension, meaningfulness is determined between the points of students with university graduated father and primary and secondary school graduate father. Also, meaningfulness is seen between the points of students with master's degree graduated fathers and the ones with primary, secondary and high school graduated fathers. On 21st century dimension, there is meaningfulness between the points of students with university graduate fathers and the ones with middle school graduate fathers. On scale dimension of attitudes towards FeTeMM (STEM), there is meaningfulness between the points of students with university graduate fathers and the ones with middle school graduate students and also students with master's degree graduate father and the ones with primary school, middle school and high school graduate father. According to these results, it can be said that father education level is an effective factor that affects 6th, 7th and 8th class students' attitude towards FeTeMM (STEM).

It is seen that on maths dimension, whose scale is created according to grade level, there is meaningfulness between the points that students gathered in general. On maths level, when the grade level increased, it is determined that the point average decreases. This result shows a parallelism with the research of Unfried & et al. (2014). Unfried & et al. (2014) mentioned that increase on grade level creates a decrease on attitude towards maths. It is foreseen that this can be because while the class increases, the intensity of subjects' increase. According to research results, it can be mentioned that class level is a factor that affects 6th, 7th and 8th grader students' attitudes towards FeTeMM (STEM).

5. Conclusion

Countries that aim qualitative human power on disciplines that are FeTeMM (STEM) centered should interfere the education system early and they should increase the career consciousness of learners. (Moore & Richards, 2012; Wyss, Heulskamp & Siebert, 2012). In order to have an increase on number of individuals that are planning to have a career on FeTeMM areas, students' interest, trust and attitude of learners towards FeTeMM (STEM) should be increased. Creating FeTeMM (STEM) centered classes rather than traditional class atmosphere can have a contribution on the

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increase of this interest. On the other hand, it is thought that making new researches with independent variables is significant in order to determine about the factors that affect learners' attitude towards FeTeMM (STEM).

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