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Teacher Candidates' Stem Awareness Levels

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Abstract
The purposes of this research are determining STEM awareness level of teacher candidates and detecting being affected situations of this awareness by different variables. This is a descriptive field research and it was conducted with scanning model. This research's study group consists of 254 (170 female and 84 male) education faculty students that are at 3rd and 4th grades of Computer, Math and Science Teaching Departments of Amasya University at 2015-2016 education year. As a data collecting tool, "STEM awareness scale" -which was designed by Buyruk and Korkmaz- was used. Within data analyzing; mean, Anova, Schieffe and T-Tests were utilized. As a result of analysis, it was seen that teacher candidates have high level of STEM awareness and gender has no effect on this awareness level. Researchers who would like to study the same issue can practice with different departments and wider study groups. Besides, they can analyze situations of awareness in terms of different variables.

Key Words: STEM, teacher candidates, awareness

INTRODUCTION

STEM is an educational approach that focuses on integrating information and skills belonging to science, technology, math and engineering with teaching which is engineering design oriented. It also aims to make students to have interdisciplinary cooperation, systematical thinking, being open to communication, having ethic values, searching, producing, creativity and abilities of solving problems appropriately. (Bybee, 2010b; Dugger, 2010; Rogers ve Porstmore, 2004) With the help of information and technology's positive effect on each other, the world develops and changes in addition to its rising population. Besides, meeting the increasing needs and keeping up with progresses are possible with innovation. Innovation concept and action requires thinking critically, solving problems, cooperation, leadership ability, flexible frame of mind, being able to adapt, entrepreneurship, being able to communicate with verbal and written ways, accessing and using information, curiosity and imaginativeness.(Wagner, 2008) Furthermore, these are defined as 21st century's skills and they are basic earnings of STEM educational approach. Of we lokomotif at from this point of view, STEM is one of the most important elements that should be included to education system for a country's progress, economical development and scientific leadership. Because of that; science, technology, engineering and math education's content, its

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theoretical and practical structure should be analyzed and assessed in school and university level.(Çorlu, vd., 2012) Because it is in the center of reforms which aim to grow up people having innovation ability. STEM (science, technology, math, engineering) education concept revealed at 1990s.(Bybee, 2010) STEM education is based on science and math disciplines. Additionally, it includes technology and math. (Bybee, 2010b) STEM education make coonections between disciplines and aims to analyze education with holistic approach. (Smith & Karr-Kidwell, 2000) Instead of analyzing all parts one by one, STEM education focuses on being performed of these disciplines all together with learning-which is intended to acquire designing research, solving problems, cooperation and effective communication- and production activity. Moreover, activities-that will rise up students' interests and orientations towards science, technology, math and engineering by using skills being named as 21st century's skills- are parts of STEM education. (Baran, Canbazoğlu Bilici, Mesutoğlu, 2015)

STEM education is an approach that aims to make students-who will lead innovations of future- to internalize creative solving problem ability by interdisciplines perspective. (Şahin, Ayar & Adıgüzel, 2014; Roberts, 2012) While reaching to this purpose, it is thought that issues including real world problems are important factors for rising up students' interest, success and motivation. (Honey, Pearson & Schweingruber, 2014) Real life problems require that students should use their high level thinking, searching and questioning skills in addition to their collaborative study. (Ercan & Bozkurt, 2013; Marulcu, 2012; NRC, 2012) Moreover, they should be aware of that a problem has more than one solution alternatives. Basicly; STEM education tries to combine science, technology, math and engineering disciplines by making connections between real life problems and lesson's content. This combining may be in two ways: making these four disciplines' contents harmonious (context integration) or around a discipline's content, making use of other disciplines (content integration). (Moore, Stohlmann, Wang, Tank ve Roehrig 2014) This combining can be practised by integrating at least two of them instead of all of them according to content and requirement. In literature, there are studies concluding that integrating science, technology, math and engineering disciplines with holistic approach has positive effects on students' interest, attitude and academic success. (Gülhan& Şahin, 2016; Baran, Canbazoğlu Bilici, Mesutoğlu, 2015; Gencer, 2015; Şahin, Ayar ve Adıgüzel, 2014; Wendell vd., 2010; Fortus vd., 2004; Roth, 2001)

Awareness is defined as being conscious and sensitive to the environment of social groups and individuals. (Keleş, 2007) With an increase in awareness level, individual's state of being conscious related to environment and himself/herself rise up. It is possible to make awareness levels to increase with the help of individual's opinions and feelings that direct his/her behaviours. This issue is particularly addressed under the direction of Gestalt psychology and cognitive-behavioral approach with the aspect of analyzing thoughts. (Akkoyun 2001, Dökmen 2000) With this context; in this research, awareness was used in the sense of awareness and sensitization training in STEM education. In some studies that was conducted in recent years(National Research Council [NRC], 2011; Schmidt, 2011), individual's failures in STEM fields and decrease in number of people that graduated from these fields are insufficiency reasons of growing generation about providing today's and future's requirements. When it is looked from this point of view, supporting STEM education and enhancing awareness with this issue are regarded as important. With this context, this research's purpose was determined in the sense of presenting teacher candidates' STEM awareness levels.

Purpose of Study

Purpose of this study is describing teacher candidates' awareness levels related to STEM. In this context; for these questions, answers were sought.

1. Generally, how are teacher candidates' awareness levels?
2. Do teacher candidates' awareness levels differentiate according to branches?
3. Do teacher candidates' awareness levels differentiate according to gender?
4. Do teacher candidates' awareness levels differentiate according to grade level?

METHOD

Study Model

This study is a descriptive research. It was conducted with scanning model. In this context, it was tried to describe teacher candidates' awareness levels.

Study Group

Study group of this study consists of 254 education faculty students that are at 3rd and 4th grades of computer, math and science teacher departments of Amasya University at 2015-2016 education year. Dispersion of study group according to branch, grade and gender qualities takes place at Table-1.

Table 1. Study group's dispersion in terms of branch, grade and gender

Branch	3. Grade		4. Grade		Total
	Woman	Man	Woman	Man	
BÖTE	18	17	15	18	68
Science teacher	43	21	53	12	129
Primary school math teacher	14	7	27	9	57
Total	75	45	95	39	254

Data Collection Tool

Research datas were collected by using "STEM awareness scale" that was designed by Buyruk and Korkmaz(baskında). Scale's validity and reliability study was done with 254 education faculty students. Construct validity of scale was tested by exploratory and confirmatory factor analysis. In addition, item discrimination and item factor correlation analysis was performed. Scale's two identical half correlations, 832; Sperman Brown reliability coefficient, 908; Guttmann Split-half value, 903; Cronbach's Alpha reliability coefficient, 927 were determined like that. "Positive Outlook" factor's identical half correlation, 873; Sperman Brown value, 932; Guttmann Split-half value, 932; Cronbach's Alpha values 0,929 were seen like that. "Negative Outlook" factor's identical half correlation, 667; Sperman Brown value, 800; Guttmann Split-half value, 764; Cronbach's Alpha value, 806. As a result of analysis, prepared in five-point Likert type "STEM awareness scale" was determined to consist 17 items and two factors. Construct validity results showed that scale served its purpose in terms of both its each item and its whole. According to results of T-tests, it was seen that difference between 27% bottom and top groups' matter points is significiant. Thus, level of distinctiveness is high. Exploratory factor analysis showed that structure of "STEM awareness scale" was verified.

Analysis of Datas

Raw scores obtained from factors have been converted to standard scores that will be 20 for the lowest and 100 for the highest. With sub-problems,; correspondingly percentage, mean, Anova, Schieffe and t-tests were used on datas. As difference and relation's meaningfulness level, p<0,05 has been regarded sufficient. In addition, as provision of standard scores; "between 20-35 points=very low", "between 36-53 points=low", "between 54-69 points=medium", "between 70-85 points=high", "between 86-100 points=very high" are defined like that.

FINDINGS

Teacher candidates' STEM awareness levels

Findings related to teacher candidates' STEM awareness levels were summarized in Table 2.

Table 2. Teacher candidates' STEM awareness levels

	X	ss	DP (%)	OP (%)	YP (%)
Positive outlook	76,50	12,8	0,4	3,1	96,5
Negative outlook	72,83	15,10	2,4	6,7	90,9
Total point	**75,42**	**12,60**	**0,8**	**3,1**	**96,1**

In Table 2; when teacher candidates' STEM awareness levels are analyzed, it is seen that average point is 75,42 and almost all of students have high STEM awareness levels. Additionally in terms of factors, situation is similar. All items in negative Outlook factor were negative and they were coded reversely before analyzing. So, point increase in this factor indicates positive awareness. According to this, it can be said that teacher candidates have high STEM awareness levels.

Teacher candidates' STEM awareness levels according to branches

In Table-3, findings related to teacher candidates' STEM awareness levels according to branches are shown.

Table 3. Teacher candidates' STEM awareness levels according to branches

		Positive outlook		**Negative outlook**		**Total**	
Sınıflar	**N**	$\bar{X}$	**S**				
CEIT	68	76,2	12,5	70,2	16,2	74,5	12,6
Science teacher	129	79,9	12,3	76,8	15,1	79,1	12,1
Primary school math teacher	57	69,06	11,4	67,1	10,7	68,5	10,1
General Average	254	76,5	27,811	7,,8	15,1	75,4	12,6

Just as it is seen in Table-2 teacher candidates' STEM awareness level total point is $\bar{X}$ =74,5 for CEIT; $\bar{X}$ =79,1 for science teacher; $\bar{X}$ =68,5 for primary school math teacher. According to this, highest points belong to science teacher candidates and lowest points belong to primary school math teacher candidates. When it is looked at in terms of factors, situation is similar. Variance analysis results-which determine whether differentiation between STEM awareness points among branches is significant or not- were summarized in Table-4.

Table 4. Effects of branches on STEM awareness levels

	Source of variance	Sum of squares	SD	Mean of squares	F	p	Significant difference
Positive outlook	intergroups	4680,017	2	2340,008	15,76	0,000	Math and others
	İn-group	37251,479	251	148,412			
	Total	41931,496	253				
Negative outlook	intergroups	4391,357	2	2195,678	10,32	0,000	Science and others
	İn-group	53367,698	251	212,620			
	Total	57759,055	253				
Total point	intergroups	4482,578	2	2241,289	15,77	0,000	Science and others CEIT and math
	İn-group	35672,620	251	142,122			
	Total	40155,197	253				

When Table 4 is analyzed, it is seen that both branches' total points[f(2-253)=15,77, p<0,05] and factors(Positive outlook [f(2-253)=15,76, p<0,05]; Negative outlook [f(2-253)=10,32, p<0,05]) make STEM awareness levels to differentiate significantly. According to this, science and CEIT teacher candidates have more STEM awareness levels than primary school math teacher candidates meaningfully. At the same time, it can be said that science teacher candidates have more STEM awareness levels than CEIT teacher candidates significantly.

Teacher candidates' STEM awareness levels according to gender

Findings related to teacher candidates' STEM awareness levels according to gender were summarized in Table-5.

Table 5. Teacher candidates' STEM awareness levels according to gender

Variables		N	$\bar{X}$	Ss	t	sd	p
Positive outlook	Girl	170	76,4	13,3	-,114	252	,910
	Boy	84	76,6	11,9			
Negative outlook	Girl	170	73,8	14,9	1,470	252	,143
	Boy	84	70,9	15,5			
Total	Girl	170	75,7	12,9	,434	252	,664
	Boy	84	74,9	11,9			

In Table-5,; it is shown that gender factor doesn't differentiate STEM awareness levels in terms of both total point (t(2-252)=,434; p>0,01) and factors(Positive outlook: t(2-252)=-,114; p>0,01; Negative outlook: t(2-252)=1,470; p>0,01). According to this, it can be said that gender has no effect on teacher candidates' STEM awareness levels.

RESULT

In this port results obtained from research's findings were interpreted and they were supported by discussing with similar studies that were done before "STEM awareness scale" was used in this study that determines teacher candidates' STEM awareness level.

As a result of study, it was shown that general STEM awareness levels of teacher candidates are quite high. A study related to innovations and changes in educatşon has been done by Akpınar& Aydın (2007) with teachers. They concluded that teachers' point of viewstowards innovations and changes are possitive. So, this finding is a supporting result and explains the reason of teacher candidates' high level of awareness linked by STEM education –which is a new approach in education-.

When it is looked at to states of teacher candidates' awareness levels according to sections, it is shown that science and BÖTE teacher candidates have more STEM awareness level than primary school math teacher candidates. In addition, science teacher candidates have more STEM awareness level than BÖTE teacher candidates significantly. The reason of science teacher candidates' high level of STEM awareness in studies based on integration of STEM education, in general, can be dealt with focusing on science.

With this study, it was shown that gender has no effect on teacher candidates' STEM awareness. In addition, Özdemir's (2012) study related tol ast grade students' ethic attitudes towards environment, Sırakaya's (2011) study linked by teacher candidates' internet self-afficacy levels and Turan's (2009) study including high school students' ecological and ethic approaches in a biology practise that is about using criticl thinking skills concluded that gender has no effect. This result is an indicative meaning that gender cannot effect on some properties. Moreover, this support the result obtained from study.

This study was done with teacher candidates. Besides, it was concluded that especially science teacher candidates have higher STEM awareness level and gender has no effect on awareness level. However, this study was performed with teacher candidates who are limited numbers and from limited branches. New studies can be done on a larger study group covering different branches. STEM awareness can be analyzed in terms of different variables can be observed. What should be done to increase the STEM awareness of teacher candidates and working teachers can be analyzed as a new study topic.

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