THE INVESTIGATION OF SCHOOL ADMINISTRATORS AND TEACHERS' AWARENESS OF STEM EDUCATION IN THE TURKISH REPUBLIC OF NORTHERN CYPRUS

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ABSTRACT
STEM education deals with education with an interdisciplinary relationship and a holistic approach (Smith & Karr-Kidwell, 2000). While it is based on science and mathematics disciplines, it also includes the fields of technology and mathematics (Bybee, 2010). STEM education emerged in the 1990s (Bybee, 2010). STEM is a system that aims to provide students with the ability to think regularly, communicate, adopt ethical values, research, produce, creativity and solve problems in the most appropriate ways by coordinating the knowledge and skills of science, mathematics, technology and engineering with disciplines. Activities that will increase the interest and desire of students with 21st century skills towards science, mathematics, technology and engineering departments are included in the content of STEM education (Baran, Canbazoğlu Bilici, Mesutoğlu, 2015). School administrators have a great role in the development of 21st century skills. The permission to use the STEM Awareness Scale and the necessary permissions were obtained from the Ministry of Education, Education and Training Department. The aim of this research is to examine the awareness of school administrators and teachers working in the Primary Education and Vocational Technical Education Department in the Turkish Republic of Northern Cyprus about STEM education. In addition, it is to examine whether the awareness of school administrators about STEM education differs according to the variables of gender, age, educational status, graduated degree program, occupational seniority, and the task performed. For this purpose, the STEM Awareness Scale was applied to a total of 126 teachers, including 43 school principal and assistants, 83 teachers, working in the schools affiliated to the vocational education department and the primary education department in the TRNC, Ministry of National Education and Culture. Due to the covid-19 epidemic, which was the sample of the research, simple random sampling method was used in random sampling methods via Google Forms. The data obtained from the scale will be analyzed with the SPSS 25 package program. T-test and one-way ANOVA test will be applied for statistical analysis in the findings of the research. The results were discussed in line with the literature. Along with the results, the STEM awareness levels of school administrators and teachers were determined and suggestions for further research were presented.
Keywords: Awareness, STEM, school principals, classroom and branch teachers.

Introduction

Definition of STEM

It is an educational approach that aims to integrate the fields of mathematics, science, technology and engineering, and aims to connect the students taking the courses between these disciplines and different disciplines, and to solve problems. STEM is also an approach that enables the fields of science, technology, engineering and mathematics to be associated with daily life (Akın, 2019).

Ceylan (2014), who has argued that STEM is an approach where students can apply the knowledge they have acquired in mathematics, science, technology, and engineering courses and aims to find original solutions, states that STEM education should be given importance in schools so that the country can become economically strong, and that the country can play a leading role in the field of science and technology (Çolakoğlu & Gökben , 2017).

STEM (Science, Technology, Engineering, Mathematics) emerged in the 1990s with the abbreviation of the first letters of the names of these disciplines for an educational purpose defined by the integration of science, technology, engineering and mathematics (Bybee, 2013; Dugger, 2010).

Features of the STEM

1. STEM education provides students with different perspectives.
2. STEM education; It encourages students to ask questions and query.
3. With STEM education, thanks to teachers, students learn in which areas they are good.
4. STEM education arouses students' curiosity and supports their exploration aspects.
5. STEM education provides cooperation between teachers and students.
6. STEM education creates a sense of responsibility in students.
7. STEM education teaches students to adapt disciplines to daily life.
8. STEM education makes a difference in education (Belek, 2018).

STEM Education and School Principals

School principals should be conscious about STEM education and should know that this education will provide students with a competence in every sense. When the managers are conscious, it is much easier to deal with the obstacles encountered. For example, when resources are insufficient in a school, the head of the school may be more active than a teacher in providing resources. School principals know school resources better, so resources can be created for STEM education by making arrangements. At the same time, school principals' knowing how important STEM education is for students will lead them to become more aware of issues such as funding or teachers' better learning of education. As a result, one of the most important points in STEM education is the willingness of school principals in this training.

STEM Education and Teachers

The attitudes and awareness levels of teachers who will implement STEM education are very important in terms of achieving success. Various teaching methods and strategies are used in STEM education. If education is to be successful, teachers must know these strategies and methods very well. If the teachers have a very good level of knowledge, their transfer level will be equally good and the students who receive training will reinforce it more. As in every education, it is normal to encounter obstacles sometimes in STEM education. Teachers are prominent people in this regard. The integrative approach of STEM education, not knowing the fields well enough, insufficient opportunities in the place where it is applied, teachers not knowing how to transfer this education, lack of communication and cooperation among the teachers can be counted as the obstacles that will arise. When teachers have sufficient knowledge of the integrative approach, strategic ways and methods, it is much easier to solve the problems (Özdemir, 2019).

One of the most important elements in STEM education is teachers because they provide the balance. The fact that the teachers who will provide STEM education have knowledge in all STEM education fields will also increase the quality of education provided. At the same time, since there are not enough studies on how to give STEM education, teachers sometimes have problems in the implementation process. As a result, the way to be successful in STEM education is possible with teachers who know and can transfer this education very well (Özdemir, 2019).

Teachers' views on STEM education depend on their level of knowledge about STEM education, their school's encouragement in the field of STEM, and their ability to find materials (Stohlmann, Moore, & Roehrig, 2012). According to the results of this research, it is important for the society to be literate in STEM fields.

Teachers also guide teaching by organizing learning environments for STEM education. Teachers' positive opinions about STEM education will contribute positively to STEM education practices (Bakırcı & Kutlu, 2018).

The existence of teachers with high awareness in STEM fields and STEM literate means individuals with high awareness (Tezsezen, 2017). The correct implementation of STEM education in the education system is closely related to teachers' awareness levels (Bakırcı & Kutlu, 2018) and their views on STEM education (Stohlmann, Moore & Roehrig, 2012). It is very important to get the opinions of teachers about STEM awareness as it will guide the practices and studies in this field.

The Aim of the Research

Bu araştırmanın amacı Kuzey Kıbrıs Türk Cumhuriyeti'nde görev yapan İlköğretim ve Mesleki Teknik Öğretim Dairesine bağlı okullarda görev yapan okul idarecilerinin ve öğretmenlerin FeTeMM eğitimi ile ilgili farkındalıklarının incelenmesidir. Ayrıca okul idarecilerinin ve öğretmenlerin FeTeMM eğitimine yönelik farkındalıklarının cinsiyet, yaş, eğitim durumu, mezun olunan lisans programı, mesleki kıdem, yapılan görev değişkenlerine göre farklılaşıp farklılaşmadığını incelemektir.

The Significant of Research

Activities that will increase the interests and orientations of students with 21st century skills towards science, technology, engineering and mathematics are included in the content of STEM education (Baran et al. 2015). School principals and teachers have great roles in the development of 21st century skills. It is very important to determine STEM awareness and evaluate it in terms of both school principals and teachers.

Methodology

Research Model

Relational screening model was used in this study. The scanning model aims to identify past or ongoing situations. The situation that is the subject of the research is handled as it is without any effort to influence it as it exists (Karasar, 2016).

In the study, it was determined whether the attitudes of school administrators and teachers towards STEM education differ according to gender, age, educational status, graduated program, occupational seniority, and current position.

The Sample of the Research

The study group in the research consists of 126 people, 43 school administrators and assistants, 83 teachers, working in Vocational Technical and Primary Schools in the TRNC in the 2020-2021 academic year. Demographic characteristics of the study group are given in the table below.

Table 1. Demographic Characteristics of the Participants

	N	%
Gender		
Female	76	60,3
Male	50	39,7
Age		
23-30 years old	16	12,7
31-40 years old	42	33,3
41-50 years old	40	31,7
50 years and older	28	22,2
Educational Status		
Undergraduate	84	66,7
Masters' Degree	36	28,6
PhD	6	4,8
Graduated Undergraduate Program		
Classroom teaching	59	46,8
Pre-school teaching	12	9,5
Others	55	43,7
Occupational Seniority		
1-10 years	23	18,3
11-20 years	53	42,1
21 years and above	50	39,7
Current Position		
Class Teacher	33	26,2
Branch Teacher	50	39,7
School Principals	21	16,7
School Vice-Principals	22	17,5
Total	126	100.0

In Table 1, the distribution of the participants in the research according to gender, age, educational status, undergraduate program graduated, occupationnal seniority and current duties are examined.

It is seen that 60.3% of the participants participating in the research are female and 39.7% are male. It is seen that the age distribution of the participants participating in the research is 12.7%, 23-30 years old, 33.3% 31-40

years old, 31.7% 41-50 years old, 22.2% 50 and over. It was determined that 66.7% of the participants were undergraduate, 28.6% master degree, 4.8% Phd. 46.8% of the participants in the research work as classroom teachers, 9.5% work as pre-school teachers, and 43.7% work in other departments. It has been determined that the professional seniority of the participants is 18.3%, 1-10 years, 42.1% 11-20 years, 39.7% 21 years and above. The current duties of the participants in the research were determined as 26.2% class teachers, 39.7% branch teachers, 16.7% school principals and 17.5% school vice-principals.

Data Collection

The data collection tool consists of two parts. In the first part, there is the "Personal Information Form", and in the second part, the STEM Awareness Scale (FFÖ) developed by Buyruk and Korkmaz. Permission to use the scale was obtained by contacting Özgen Korkmaz, who developed the scale, via e-mail. Due to the covid-19, the scale was arranged in Google Forms and sent to the participants. Necessary explanations were made while filling out the form and scale.

STEM Awareness Scale

The "STEM Awareness Scale" developed by Buyruk and Korkmaz consists of 17 items. The reliability analysis of the scale, Cronbach's Alpha reliability coefficient was found to be ,927. Regarding the "Positive Perspective" factor; Cronbach's Alpha values were found to be .929. Regarding the "Negative View" factor; Cronbach's Alpha value was found to be reliable as 806 (Hebebci, Usta, 2017).

The options for the 17 items in the scale are (1) Strongly Disagree, (2) Disagree, (3) Neutral, (4) Agree, (5) Strongly Agree.

Data Analysis

SPSS 25 package program was used in the statistical analysis of the study. It was checked whether the survey results obtained from the individuals participating in the study were normally distributed. The assumptions of the parametric and non-parametric tests were tested and it was determined that the data were nonparametric while deciding on the statistical techniques performed for the purposes. Mann Whitney U and Kruskal Wallis tests, which are nonparametric tests, were used to test the variables according to sub-objectives. In order to determine the significant difference, the p value was calculated as 0.05. K Indepented Samples tests, one of the nonparametric tests, were applied because they did not show normal distribution during the analysis.

Findings

Awareness Levels of School Principals and Teachers on the STEM Education Approach

Table 2. Descriptive Statistics of the Data

	N	Min.	Max.	x̄	ss
STEMM awareness scale Total	126	2.06	4.94	3.70	.354

As can be seen in Table 2, the smallest value obtained from the answers of the scale was 2.06 and the highest value was 4.94. The total STEM awareness mean of the scale was found to be (x̄ =3.70, sd=.354). The STEM awareness of school principals and teachers participating in the research was found to be high.

Table 3. Mann Whitney – U Test Results of STEM Awareness Levels According to Gender Variable

	Variables	**n**	**S.O**	**S.T**	**U**	**p**
STEMM Awareness	Female	76	64,61	4910,00	1816,000	0,67
	Male	50	61,82	3091,00		

p>0,05

As a result of the Mann Whitney – U Test for STEM Awareness Measurements performed according to Table 3, it was determined that the awareness levels of the individuals (U=1816.00; p>.05) according to the gender variable did not show a statistically significant difference.

Table 4. Analysis of STEM Awareness Levels by Age Variable

	Variables	n	S.O	H	df	p
STEMM Awareness	23-30 years old	16	68,22	1,111	3	0,77
	31-40 years old	42	63,06			
	41-50 years old	40	65,96			
	50 years and older	28	57,95			

p>0,05

The results of the Kruskal Wallis test, which was conducted to determine whether the STEM awareness levels of individuals show a significant difference according to the age group variable, are shown in Table 4. As seen in Table 4, the lowest mean score of the STEM awareness scale in the mean ranks of the individuals according to the age variable of the STEM awareness scale was composed of individuals aged 50 and over, with an average of 57.95. The highest average score was formed by individuals between the ages of 23-30 with an average of 68.22. There was no significant difference between the STEM Awareness scale scores and the age variables of the individuals (p=0.77; p>0.05).

Table 5. Findings Obtained According to the Variable of Educational Status of STEM Awareness Levels

	Variables	n	S.O	H	df	p
STEMM Awareness	Undergraduate	84	64,51	0,985	2	0,61
	Master Degree	36	63,53			
	Phd	6	49,25			

p>0,05

The results of the Kruskal Wallis test, which was conducted to determine whether there was a significant difference in the level of STEM awareness of individuals on the variable of educational status, are given in Table 5. As can be seen in Table 5, the lowest mean score of the STEM awareness scale in the mean rank of individuals according to the educational status variable of the STEM awareness scale was formed by the individuals with a doctorate with an average of 49.25, while the individuals with a bachelor's degree with an average of 64.51 formed the highest score. There was no significant difference between the STEM Awareness Scale scores and the age variables of the individuals (p=0.61; p>0.05).

Table 6. Findings Obtained for the Variable of STEM Awareness Levels of Undergraduate Program Graduated

	Variables	n	S.O	H	df	p
STEMM Awareness	Classroom teaching	59	65,64	0,842	2	0,,65
	Pre-school teaching	12	55,17			
	Others	55	63,03			

p>0.05

The results of the Kruskal Wallis test, which was conducted to find out whether there is a significant difference in the STEM awareness levels of the individuals on the variable of the undergraduate program graduated, are given in Table 6. As seen in Table 6, the lowest mean score of the STEM awareness scale in the mean ranks of the individuals according to the variable of the undergraduate program graduated from is the participants who are pre-school teachers with an average of 55.17. The highest average score was formed by the participants in the classroom teaching range with an average of 65.64. There was no significant difference between the STEM Awareness Scale scores and the age variables of the individuals (p=0.61; p>0.05).

Table 7. Findings Obtained in Terms of Occupational Seniority Variable of STEM Awareness Levels

	Variables	n	S.O	H	df	p
STEMM Awareness	1-10 years	23	62,20	0,851	2	0,65
	11-20 years	53	66,93			
	21 years and above	50	60,46			

p>0,05

The results of the Kruskal Wallis test, which was conducted to find out whether there is a significant difference in the STEM awareness levels of individuals on the variable of occupational seniority, are shown in Table 7. As can be seen in Table 7, the lowest mean score of the STEM awareness scale in the mean ranks of the individuals according to the occupational seniority variable of the STEM awareness scale was formed by individuals aged 21 and over with an average of 60.46. The highest average score was formed by individuals between 11-20 years with an average of 66.93. There was no significant difference between the STEM Awareness Scale scores and the variables of years of occupational seniority (p=0.65; p>0.05).

Table 8. Findings obtained according to current position variable for STEM awareness levels

	Variables	n	x	Sd	p	Fark
STEMM Awareness	Class Teacher	33	3,40	0,39	0,00*	4>3 3>2 2>1
	Branch Teacher	50	3,41	0,34		
	School Principals	21	3,57	0,23		
	School Vice-Principals	22	3,69	0,32		

p<0.05*

As a result of the Kruskal Wallis Test for non-parametric measurements made according to Table 8, the scores of school vice-principals (3,69±0,32) of STEM awareness levels according to the current position variable were found to be higher than the scores of the school principal (3,57±0,23), branch teacher (3,41±0,34) and classroom teachers (3,40±0,39).

Discussion

In the study, no significant difference was found between age, educational status, undergraduate program graduated and STEM awareness scale. However, according to the current position variable, the scores of school vice-principals were found to be higher than the scores of the school principal, branch and classroom teachers.

In the thesis study of Ciğerci (2020), titled "Examination of School Administrators and Teachers' Awareness of STEM Education", no significant difference was found between occupational seniority, task, age and STEM awareness.

In the study conducted with pre-service science teachers, the STEM awareness of the candidates was examined and no significant difference was found in terms of STEM awareness of gender (Kızılot,2019). In the study conducted with secondary school teachers, no significant difference was found in terms of gender STEM awareness (Çevik, Şanlıtürk, Yağcı, 2017). In the study examining the STEM awareness of classroom teachers, no significant difference was found according to gender, the program they graduated from and occupational seniority (Özdemir, 2019).

Conclusion and Recommendations

1. The awareness of school principals and teachers on STEM education was determined using the scale. In addition to the scale results with semi-structured questions, different results can be determined by doing research with STEM awareness and mixed method.
2. With high awareness, detailed information can be obtained with semi-structured interview questions in order to see the reflection of these awarenesses in educational environments concretely.
3. Consistency studies on students' awareness levels can be carried out in parallel with the school principal and teachers.
4. Teachers and administrators can be supported with practical in-service trainings to raise awareness.

References

Akın, V. (2019). *FeTeMM Uygulamalarının 7. Sınıf Öğrencilerinin FeTeMM'e Yönelik Tutumlarına, Bilimsel Süreç Becerilerine ve Meslek Seçimlerine Etkisi* (Master Thesis). Obtained from the National Thesis Center of the Council of Higher Education. (Thesis No: 554602).

Bakırcı, H. & Kutlu, E. (2018*).* Fen bilimleri öğretmenlerinin FeTeMM yaklaşımı hakkındaki görüşlerinin belirlenmesi. *Türk Bilgisayar ve Matematik Eğitimi Dergisi*, 9(2), 367- 389.

Belek, F. (2018). *FeTeMM Etkinliklerinin, Fen Bilgisi Öğretmen Adaylarının Öz-Yeterlilik İnançlarına, FeTeMM Eğitimi Yaklaşımlarına ve Fen Öğretimine Yönelik Düşüncelerine Etkisinin İncelenmesi* (Master Thesis). Obtained from the National Thesis Center of the Council of Higher Education. (Thesis No: 528343).

Bybee, R. W. (2013). *The Case for STEM education: Challenges and opportunities. Ar-lington, Virginia: NSTA Press.*

Ceylan, S. (2014). *Ortaokul Fen Bilimleri Dersindeki Asitler ve Bazlar Konusunda Fen, Teknoloji, Mühendislik ve Matematik (FeTeMM) Yaklaşımı ile Öğretim Tasarımı Hazırlanmasına Yönelik Bir Çalışma*. Uludag University Institute of Educational Sciences. Bursa

Ciğerci, D., (2020). *Okul Yöneticilerinin ve Öğretmenlerin FeTeMM Eğitimine Yönelik Farkındalıklarının İncelenmesi* (Master Thesis). Obtained from the National Thesis Center of the Council of Higher Education. (Thesis No: 0000-0003-1947-2107).

Çevik,M., Danıştay, A.,Yağcı, A. (2017). Ortaokul Öğretmenlerinin FeTeMM Farkındalıklarının Farklı Değişkenlere Göre Değerlendirilmesi. *Sakarya Üniversitesi Eğitim Bilimleri Dergisi* 7(3),584-599.

Dugger, E. W. (2010*). Evolution of STEM in the United States. 6th Biennial International Conference on Technology Education Research, Australia. Retrieved* from http://www.iteea.org/Resources/PressRoom/AustraliaPaper.pdf.

Hebebci, M., Usta, E. (2017). Üniversite Öğrencilerinin FeTeMM Farkındalıklarının İncelenmesi. Türk Bilgisayar ve Matematik Eğitimi Sempozyumu. Afyon.

Karasar,N. (2016). *Bilimsel Araştırma Yöntemi: Kavramlar, İlkeler, Teknikler*. (31.Ed.). Ankara: Nobel Yayıncılık.

Kızılot,M. (2019). Fen Bilgisi Öğretmen Adaylarının Entegre FeTeMM Öğretimi Yönelimlerinin ve FeTeMM Farkındalıklarının Belirlenmesi. (Unpublished Master Thesis). Onsekiz Mart University, Institute of Educational Sciences, Çanakkale.

Moore, T.J. & Smith, K.A. (2014). Advancing the state of the art of STEM Integration. *Journal of STEM Education*, 15(1), 5-10.

Özdemir, A. U. (2019). *Sınıf Öğretmenlerinin FeTeMM Farkındalık ve FeTeMM Eğitimi Uygulamalarına Yönelik Görüşleri* Obtained from the National Thesis Center of the Council of Higher Education. (Thesis No: 540876).

Stohlmann, M., Moore, T.J. & G.H. Roehrig G.H. (2012). Considerations for teaching integrated STEM education. *Journal of Pre-Collage Engineering Education Research*, 2(1), 28- 34.

Tezsezen, S. (2017) *Öğretmen adaylarının FeTeMM farkındalıklarının FeTeMM alanları tanımları ve ilişkileri üzerinden incelenmesi*. Master Thesis, Bogazici University, Istanbul.

