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Qualifications, Problems and Solution Recommendations of Teachers in Science, Engineering and Entrepreneurship Practices[1]

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Abstract

The aim of this research is to investigate science teachers` awareness, entrepreneurship levels within the scope ofthe STEM approach and to identify the teachers' competencies, opinions, problems and solution suggestions within the scope of Science, Engineering and Entrepreneurship Practices. In the study, the STEM-Awareness Scale, the Entrepreneurship Scale and a semi-structured interview form developed by the researcher were used as data collection tools. According to the results of the research, it was determined that the STEM awareness levels of science teachers were sufficient, and their STEM awareness did not differ according to gender and professional field. When the entrepreneurship levels of the teachers are evaluated, it is seen that they see themselves as sufficient, and that entrepreneurship does not differ according to gender and professional seniority.In the semi-structured interview results, it was determined that the majority of science teachers did not receive education within the scope of the STEM approach, they found themselves inadequate in the fields of education, encountered many problems while applying STEM, and conditions affected them negatively. The most emphasized situation in the suggestions given by the teachers within the scope of the research is that STEM education should be taken.

INTRODUCTION

Today, rapid progress in fields such as science, technology, mathematics and engineering and the needs of society necessitate a sustainable change on the individual. Bringing 21st-century skills to individuals has become important for countries that want to gain a greater share from science and developing technology. Developed countries 21st-century aim to raise individuals who have critical, analytical and creative thinking skills, who can integrate what they have learned into daily life, who have developed communication skills, who are researching and questioning (National Research Council [NRC], 2009). This process is similar when evaluated on the individual. Because, in the new understanding of education, individuals should be trained with the skills to solve problems, produce information, seek and find information, be creative, use technology significantly, evaluate events with a flexible and holistic perspective, and work as a team. (Hançer, Şensoy, & Yıldırım, 2003). Although traditional methods have a place in education, for example, as a 21st-century skill, it is not active in entrepreneurship education, and therefore new approaches are needed (Berková et al., 2020). Depending on the individual and social developments, different education levels are negatively affected by the changed curriculum. For this reason, it is argued that an interdisciplinary approach is necessary for education reforms, and this need can be fulfilled with STEM (Science-Technology-Engineering-Mathematics) education (Çepni, 2017). The STEM education approach to the current science curriculum may differ from country to country (Ritz & Fan, 2015). The STEM education approach has been included in the science curriculum in Turkey as science, engineering and entrepreneurship practices (MEB, 2018). This study focuses on the practical problems and solution proposals regarding STEM education as a product of the improvement efforts in education that have been continuing since the beginning of the twenty-first century.

Science, Engineering and Entrepreneurship Applications in Science Education

Bybee (2010) defined STEM education as an education system aiming at the integration of science, technology, engineering and mathematics fields with each other. STEM education is not a separate course, but a paradigm in which disciplines such as science and mathematics are blended with technology and engineering-based design applications. Thus, STEM education can be considered an educational process that includes better quality learning by bringing together different and related disciplines and using the information obtained as a result of this learning in daily life, increasing living standards and critical thinking (Yıldırım & Altun, 2015). STEM education is based on interaction through the different disciplines; it contains and aims to develop students' knowledge and life skills through science learning. Therefore, individuals are expected to learn the events related to science within the scope of STEM education, adding better meaning to real life and ensuring permanent learning. The development of countries in scientific and economic fields and its continuity due to this development made it mandatory to support STEM education (Bahar et al., 2018). In order for the student to find a place in life productively in the future, there is a need for active methods that can support entrepreneurship in learning environments (Havlicek et al., 2014). Because STEM education is an approach that aims to train individuals who can produce by following technological and scientific developments (Bray, 2010). Updated curricula and Science in Turkey in 2017, the course "Science and Engineering Applications" unit has been added (Ministry of Education [MEB], 2017). In this context, it is planned to develop engineering skills. In the 2018 curriculum, the term entrepreneurship was added to science and engineering practices, and a joint unit was included under the name of "Science, Engineering and Entrepreneurship Practices" (MEB, 2018). Therefore, the STEM education approach and entrepreneurship be targeted in an integrated process. STEM implementation is planned as a systematic instructional design aiming at an entrepreneurship-oriented learning strategy that integrates entrepreneurship sub-dimensions into learning materials and activities under teacher guidance (Adeyemo, 2009). It is a fact that an individual can develop in entrepreneurship within the scope of STEM education. In this direction, the concept of entrepreneurship also becomes important. Entrepreneurship is the ability to transfer or use knowledge to a new situation and to develop the existing situation by making an effort and carrying out risk activities within the scope of the individual's field. The Ministry of National Education also aimed to gain skills in entrepreneurship and included it in the curriculum. The concept of entrepreneurship in the curriculum in Turkey in 2017, was among the concept to gain life skills considered (MEB, 2017). Entrepreneurship education is defined as a process that allows students to use and develop their skills, take risks and courage, and bring their skills to life. Integration of entrepreneurship into the education system; It is also very important in terms of creating, disseminating, implementing and accelerating new ideas (Çelik, Bacanak, & Çakır, 2015; Özkul & Dulupçu, 2007). Therefore, the concept of entrepreneurship provides new opportunities for both education and the individual. In addition, it should be seen that STEM education understanding, which overlaps many objectives with science education, can develop more entrepreneurial characteristics by indirectly entering the curriculum (Ezeudu, Ofoegbu & Anyaegbunnam, 2013).

Even if the curriculum is fully prepared theoretically (Kubat, 2015), the basic philosophy and vision of the program should be internalized by teachers (Tekbıyık & Akdeniz, 2008), and teachers should contribute to solving the problems that arise during the implementation of the program (Karatepe et al., 2004). Teachers are the ones who will apply whatever changes are made in line with these programs. In this respect, the effectiveness of the renewed science program in practice can be understood from teachers' views (Selvi, 2006). Because for the successful realization of STEM education, it is closely related to the knowledge, skills and experiences of the teachers who provide this education. (Aslan-Tutak, Akaygün, & Tezsezen, 2017).

When the studies on STEM education approach are examined; teachers are unfamiliar with the term STEM (Çevik, Danıştay, & Yağcı, 2017), they want to apply STEM-based courses, but they have problems in procuring time and materials, and that the number of in-service trainings provided is insufficient (Eroğlu & Bektaş, 2016), also they are inadequate to gain engineering and design skills. Sarı and Yazıcı (2019) argue that STEM education is only prone to physics issues, that the cost is high and it creates a limitation proportional to technological insufficiency (Bakırcı & Kutlu, 2018). In studies conducted abroad within the scope of STEM education, it was determined that students studying in schools where STEM education was dominant performed better than students in other schools (Erdoğan & Stuessy, 2015), and STEM education made them eager to teach Mathematics subjects (Elliott et al., 2001). Similarly, McDonald (2016) suggests that a qualified teacher will have a positive effect on student success. On the other hand, teachers practicing STEM education traditionally focused only on science and mathematics teaching (Moore & Smith, 2014), had problems using different disciplines together (Breiner et al., 2012), found the use of engineering design interesting, but it was determined that they did not include them in their classes due to the difficulty (Capobianco, 2011). In addition, the need for teachers to have a comprehensive content knowledge of STEM education (Wang et al., 2011) are important points determined in their overseas studies.

In terms of entrepreneurship, it is stated that the increase of teachers' awareness of STEM will positively reflect on entrepreneurial characteristics, and it is pointed out that there is an important relationship between STEM awareness and entrepreneurial characteristics (Deveci, 2018). One of the important factors in determining entrepreneurial activity in a country is education (Verheul et al., 2002). However, it was stated by the teachers that the activities in the textbooks are not sufficient in terms of developing the concept of entrepreneurship (Bakırcı & Öçsoy, 2017). In this context, one of the closest educational approaches to training individuals with entrepreneurial skills is STEM education (Roberts, 2012; National STEM Education Center, 2014). As a matter of fact, it was stated that the concept of entrepreneurship should be emphasized in STEM education and that the entrepreneurial thinking style complements and improves the knowledge in STEM disciplines (Shahin et al., 2021). In this direction, it is stated that students' entrepreneurial thoughts can be developed with STEM training with first-hand experiences (Jin, Li Yang, & Son, 2015). As Srikoom, Hanuscin, and Faikhamta (2017) stated, teachers' expertise in all areas that make up the STEM training improves the quality of this training. In this respect, it will be beneficial to the literature in terms of evaluating the process from the whole perspective by describing the competencies of teachers about STEM and entrepreneurship skills in science, engineering and entrepreneurship applications through the direct education program and analyzing the findings.

When the studies are classified, it can be seen that the studies are related to STEM education and entrepreneurship. However, Science, Engineering and Entrepreneurship Applications is a new concept in the 2018 curriculum and needs to be examined in detail. Through this change, it is necessary to analyze in detail how 21st-century learning activities will contribute to the individual and how effectively they can be given in line with STEM education understanding.In the study, in line with the ascertainment made, the questions what are the competencies of science teachers in science, engineering and entrepreneurship applications, their problems and their solution suggestions in this context were focused on, and the answers were sought for the following problems:

1. What are the STEM awareness levels of science teachers?
2. Do teachers' STEM awareness differ according to gender and professional seniority?
3. What are the entrepreneurship levels of science teachers?
4. Is there a relationship between gender and professional seniority and teachers' perception of entrepreneurship?
5. What are the competencies of teachers within the scope of Science, Engineering and Entrepreneurship Practices, the problems they face and their solution suggestions for these problems?

METHOD

Study Design

In the study, a mixed method design, in which quantitative and qualitative research designs are considered together, was used. In the research, it was provided to establish a bridge between the two research methods with the mixed research method (Onwuegbuzie & Johnson, 2004). In the study, the sequential explanatory design was preferred among the types of mixed method design. The descriptive method was used as the quantitative research design of the research, and phenomenology (phenomenology) was used as a qualitative research design.

Working Group

The study group of the research consists of 34 Science teachers working in İdil District of Şırnak Province in the 2019-2020 academic year. A convenience accessible sampling method was preferred in determining the research group. A convenience accessible sample brings speed and practicality to the research (Çepni, 2001).

Data Collection Tools

The STEM Awareness Scale (SAS) and the Entrepreneurship Scale were used to collect quantitative data in the study. The STEM awareness scale developed by Çevik (2017) consists of 15 items and is a 5-point Likert type. Çevik (2017) found the general Cronbach Alpha reliability value of the scale 0.82 and the coefficients of each sub-factor 0.70. The Entrepreneurship Scale developed by Deveci and Çepni (2015) has a total of 38 items and is a 5-point Likert type. The Cronbach Alpha reliability coefficient of the study is .77, and the lowest correlation coefficient for Test-Retest reliability is .66 (Deveci & Çepni, 2015).

A semi-structured interview form was used to collect qualitative data. The interview form is used to determine the individual's feelings and thoughts about the subject within the framework of pre-determined questions (Çepni, 2014). The questions were prepared by the researcher and the opinions of the science teachers were taken, and the study was completed by making a pilot application.The final version consisted of 9 questions and the interview period lasted approximately 30 minutes with each participant.

Data Analysis

Descriptive analysis was made in the analysis of quantitative data in the study. The compliance of the data to normal distribution was determined by the Shapiro Wilks test, and a normal distribution was observed. Then, independent samples t-test was used to determine the significant difference for variables. Another criterion that shows whether the difference between the results of the groups in the study is significant is the effect size (Kılıç, 2014). Cohen's d value was calculated for sub-dimensions that differ significantly as a result of the T-Test. Content analysis technique was used in the analysis of qualitative data. In this technique, similar data are brought together within the framework of certain concepts and themes and classified in an order that the reader can understand (Merriam, 2009; Yıldırım & Şimşek, 2011). All forms were given names such as ST1 (Science Teacher 1), ST2, …… and then they were coded by considering the relevant concepts. After these analyzes, themes were determined, categorized, and direct quotations were included.

FINDINGS

The findings obtained from the qualitative and quantitative data determined according to the research problem were given and interpreted separately.

Findings and Interpretation of STEM Awareness Scale

The average and standard deviation results of teachers' STEM awareness scale are given in Table 1.

Table 1. STEM awareness levels of science teachers

Dimensions	N	Mean	SS
Student Effect	34	4.55	.45
Effect on the lesson	34	2.60	.47
Effect on Teacher	34	3.63	.50
STEM (Total)	34	3.59	.36

Table 1. when analyzed, it is seen that the average of the student effect sub-dimension is Strongly Agree, the average of the lesson effect sub-dimension Disagree, the effect on the teacher, and the average of the STEM sub-dimension corresponds to the Agree interval. In order to see the effect of gender on STEM awareness in the study, independent groups t-test was applied and table too presented in.

Table 2. Analysis of STEM awareness scale by gender

STEM Awareness Scale	Gender	N	Mean	SS	SD	t	p	d
Student Effect	Female	16	4.43	.51	32	-1.51	.141	
	Male	18	4.66	.37				
Effect on the Lesson	Female	16	3.76	.42	32	-1.07	.292	
	Male	18	3.93	.50				
Influence on Teacher	Female	16	21.19	.46	32	-2.12	.042	.73
	Male	18	14.2	.49				
STEM (Total)	Female	16	4.09	.34	32	-2.22	.034	.76
	Male	18	4.33	.29				

*p<.05

Table 2. when examined, it was determined that there was no statistically significant difference in the sub-dimensions of the scale in terms of the student effect and the effect on the lesson sub-dimensions according to gender ($t(32) = -1.51$, $t(32) = -1.07$, $p > .05$). It was determined that the scores of the science teachers STEM (total) and the effect on teacher sub-dimension show a statistically significant difference according to gender ($t(32) = -2.22$, $t(32) = -2.12$, $p < .05$). In Cohen's d calculation made to determine the importance of the difference between the results of this situation, which emerged in these sub-dimensions, it was determined that the difference between the two groups was significant. In order to understand whether the duty years of the group participating in the study coincide with different years and whether this situation differs on STEM, independent groups t-test has been applied and is presented in Table 3.

Table 3. Analysis of STEM awareness scale by professional seniority

STEM awareness scale	Year of duty	N	Mean	SS	SD	t	p
Student effect	1-5	25	4.47	.45	32	-1.83	.076
	6-10	9	4.78	.40			
Effect on the lesson	1-5	25	3.83	.43	32	-.432	.669
	6-10	9	3.91	.58			
Influence on teacher	1-5	25	4.18	.53	32	-.073	.942
	6-10	9	4.19	.45			
STEM (Total)	1-5	25	4.18	.33	32	-1.194	.241
	6-10 Year	9	4.33	.36			

*****$p < .05$

When the average scores of science teachers in all sub-dimensions of the scale were examined, although it increased as the seniority level increased, this difference obtained was not statistically significant ($t(32) = -1.83$, $t(32) = -.432$, $t(32) = -.073$, $t(32) = -1.194$, $p > .05$).

Findings and Interpretation of the Entrepreneurship Scale

Average and standard deviation results within the scope of the responses given to the scale applied to measure the entrepreneurship levels of the study group are given in Table 4.

Table 4. Entrepreneurship Levels of Science Teachers

Dimensions	N	Mean	SS
Risk-Taking	34	3.84	0.66
Seeing Opportunities	34	4.08	0.44
Trust Yourself	34	4.21	0.45
Emotional Intelligence	34	3.90	0.40
Being Innovative	34	3.53	0.51
Entrepreneurship (Total)	34	3,92	0.33

Table 4. when analyzed, the average of risk-taking, seeing opportunities, emotional intelligence, being innovative and entrepreneurship (total) sub-dimensions coincided with the Agree interval. In the self-confidence subscale, the average score is in the range of "Completely

Agree". Within the scope of the research, in order to see the effect of gender on the perception of entrepreneurship, independent groups t-test analysis is given in Table 5.

Table 5. Analysis of entrepreneurship scale according to gender

Entrepreneurship Scale	Gender	N	Mean	SS	SD	t	p
Risk-Taking	Female	16	3.64	.76	32	-1.67	.11
	Male	18	4.01	.51			
Seeing Opportunities	Female	16	3.97	.45	32	-1.34	.19
	Male	18	4.17	.42			
Trust Yourself	Female	16	4.27	.40	32	.66	.52
	Male	18	4.17	.49			
Emotional Intelligence	Female	16	3.94	.36	32	.55	.59
	Male	18	3.86	.44			
Being Innovative	Female	16	3.63	.58	32	1.08	.29
	Male	18	3.44	.45			
Entrepreneurship(Total)	Female	16	3.90	.36	32	-.39	.70
	Male	18	3.94	.31			

*****p<.05

When the data were examined, it was determined that all sub-dimensions of the Entrepreneurship Scale did not show a statistically significant difference according to gender (t (32) = - 1.67, t (32) = - 1.34, t (32) =. 66, t (32) =. 55 t (32) = 1.08, t (32) = -. 39 p> .05). Independent groups t-Test was applied to understand the difference of years of duty in the study group and whether this situation differentiated on entrepreneurship. The analysis made is presented in Table 6.

Table 6. analysis of entrepreneurship scale by professional seniority

Entrepreneurship Scale	Year of duty	N	Mean	SS	SD	t	p
Risk-Taking	1-5	25	3.76	.66	32	-1.134	.265
	6-10	9	4.05	.64			
Seeing Opportunities	1-5	25	4.02	.43	32	-1.245	.222
	6-10	9	4.23	.46			
Trust Yourself	1-5	25	4.17	.42	32	-.934	.357
	6-10	9	4.33	.51			
Emotional İntelligence	1-5	25	3.91	.34	32	.189	.851
	6-10	9	3.88	.57			
	1-5	25	3.58	.52			

Being Innovative					32	.932	.358
	6-10	9	3.40	.49			
	1-5	25	3.90	.33			
Entrepreneurship(Total)					32	-.717	.479
	6-10	9	3.99	.33			

*p<.05

When the analysis was examined, it was determined that there was no significant difference in all sub-dimensions (t (32) = - 1.134, t (32) = - 1.245, t (32) = -. 934, t (32) =. 189, t (32) = bw.932, t (32) = -. 717 p> .05).

Findings of Qualitative Data

In this section, findings obtained from the semi-structured interview questions are included. The problems experienced by the science teachers within the scope of Science, Engineering and Entrepreneurship Practices are given in Table 7.

Table 7. Teachers' views regarding the problems experienced within the scope of STEM education

Theme	Codes	f	%
Problems Encountered in the Application of STEM Education	Lack of material affects application	38	17
	I don't know STEM, and therefore I can't apply	28	12.5
	Lack of laboratory negatively affects the application	20	8.93
	I did not receive STEM training	18	8.04
	Too much class size affects practice	17	7.59
	I cannot associate the curriculum with STEM	12	5.36
	Time problem is affecting the application	12	5.36
	I cannot reflect the (cognitive, affective and psychomotor) skills in line with STEM education	10	4.46
	I cannot apply STEM to every Science subject	10	4.46
	Economic insufficiency affects the implementation	10	4.46
	Physical insufficiency of the school	8	3.57
	I cannot relate between Science and Mathematics	7	3.12
	Students' literacy problem	7	3.12
	Lack of possibilities	7	3.12
	The exam system is a problem	4	1.78
	Family indifference affects practice	4	1.78
	Technological deficiency	4	1.78
	Students' Math problem affects practice	3	1.34
	I did not receive practical training	3	1.34
	I do not apply STEM due to subject density	2	0.89

Table when examined, it was determined that there are many problems teachers have experienced within the scope of STEM education. Some teachers' views on the subject; ST29: “I did not receive any training related to STEM education.” ST16: “I do not consider yourself competent. Because I mostly support the reading, comprehension and writing activities of the students.” ST3: “Although not in every subject, I try to apply especially in physics related subjects. In this context, I think that more time should be given for these applications in the curriculum.”, ST9: “The material and the physical condition of the school affect the practice. Some shortcomings can be compensated, but there are cases where there is no compensation. For example, the class size.”, ST4: “In some schools, teachers cannot find even an empty classroom, in some other schools, the lack of opportunities in our region, the insufficiency of the schools, the situation such as the lack of opportunities of the student affects STEM implementation negatively in the form.” They also provided solutions to the problems of teachers' STEM education. The suggestions stated by the research group are presented in Table 8.

Table 8. Solution suggestions from the working group

Theme	Codes	f	%
Solution Suggestions for STEM Education	STEM training for teachers	20	16
	Establishing technological infrastructure	12	9.6
	Material coverage for STEM should be provided	12	9.6
	Integration of teachers with the STEM approach	11	8.8
	Time should be allowed to apply STEM in lessons	9	7.2
	Planning schools for STEM education	9	7.2
	Classroom integration with STEM	9	7.2
	Ensuring equal opportunity and opportunity	8	6.4
	Achievements are STEM-focused	7	5.6
	Attention should be paid to regional situations with STEM application	7	5,6
	Self-improvement of teachers	5	4
	STEM education being practical rather than theoretical	4	3.2
	The courses are intertwined with STEM education	4	3.2
	Integration of the curriculum with STEM	3	2.4
	Science and Mathematics integration in undergraduate education	3	2.4
	Elimination of teacher shortage	2	1.6

Table 8 when examined, it is the most shared suggestion that teachers should receive STEM education. Teachers' opinions on this subject; ST5: "I think that teachers' deficiencies should be eliminated, teacher shortages should be eliminated, children should receive proper education from the very beginning, equality of opportunities should be ensured." ST24: "The conditions for teachers, schools, the region and even the country should be provided for STEM.", ST33: " According to STEM, it means helping schools for STEM, organizing it, and developing materials that can be used many times.”, ST6: “Since STEM is an applied education after all, situations such as students' teacher shortage should be eliminated, and literacy should be completed will reduce the problems. It would be nice to give education to science teachers to use mathematics while undergraduate education is given.”

DISCUSSION

Within the scope of the research, it was determined that the STEM awareness levels of the teachers were sufficient.There are many studies with similar results (Duygu, 2018; Ciğerci, 2020). Cigerci (2020) found in his thesis that teachers' STEM awareness was high. In the analysis of the gender dimension in The STEM awareness scale, a significant difference was found in the sub-dimensions of "Effect on Teacher" and "STEM".In addition, it was determined that the significant difference was considered significant with Cohen's d calculation made as a result of this significant difference. When studies similar to this study were examined, they found it significant in terms of the gender factor (Karakaya et al., 2018). In other studies, there is no significant difference between the gender factor and STEM awareness (Çevik, Danıştay, & Yağcı, 2017; Kızılot, 2019). It was determined that the STEM awareness of science teachers did not differ significantly in all sub-dimensions according to professional seniority. Cigerci (2020) stated in his thesis that there is no significant difference between the STEM awareness level of teachers and professional seniority. Likewise, Özdemir and Cappellaro (2020) found in their study that there is no significant difference between STEM awareness and professional seniority. Unlike the results of the research, Şahin (2019) stated in his thesis that the STEM awareness of teachers with professional seniority of 1-5 years is higher, while Avcı (2014) stated in his study that the level of technological knowledge generally decreases as professional seniority increases.

It has been determined that science teachers consider themselves competent within the scope of the answers they gave to the Entrepreneurship Scale. Similar to this situation, it has been determined in other studies that teachers' entrepreneurship characteristics are high (Pan & Akay, 2015; Köstekçi, 2016). When the entrepreneurship status is examined in terms of gender variable, it is determined that there is no significant difference. Similarly, in their study, Pan and Akay (2015) stated that there is no significant difference in entrepreneurship by gender. Yılmaz and Sünbül (2009) found a similar result in their study. At the same time, it was determined that there was no significant difference in the entrepreneurship scale in general and in all sub-dimensions according to the years of professional seniority of the teachers. However, in another study, it was stated that the entrepreneurship perceptions of teachers with 1-5 years of professional seniority were composed of standard information, and they were not aware that the concept of entrepreneurship was included in the curriculum (Deveci, 2017).

In this part of the study, the findings of the qualitative data collection tool are discussed and concluded. The majority of the teachers stated that they did not receive any training on STEM, and they were insufficient in knowledge even about how the STEM approach was. Timur and İnançlı (2018) stated that the participants did not have enough information about STEM education. Stohlmann et al. (2012), on the other hand, stated that teachers have problems in STEM practices and they consider themselves inadequate. Most of the teachers stated that they had problems with associating Science, Engineering and Entrepreneurship Practices with science subjects and that they could be done more in physics. Similarly, Eroğlu and Bektaş (2016) think that teachers' activities with STEM mostly fall into the subject area of physics lessons. In addition, it was found that teachers had problems with associating science and mathematics with the STEM interdisciplinary approach. Kızılay (2016), on the other hand, is the result of his study that there is mostly a one-way relationship between science and mathematics. Karaer (2006) stated in his research that the students' lack of mathematics also affects their situation towards science lessons. Yaman et al. (2017) stated that teachers' problems include not knowing the curriculum of other fields within the scope of their studies.

Science teachers stated that the concept of time, lack of laboratories, lack of materials affect the application, and the inadequacy of the economic level of the student and the class size prevent STEM activities. In other studies, it has been stated that there are limitations in terms of STEM (Bakırca & Kutlu, 2018). They stated that they also had problems in acquiring cognitive, affective and psychomotor skills. Teachers in science teaching will also address the individual differences and interests of students by using different disciplines together (Hacıoğlu, Yamak and Kavak, 2016). In fact, they stated that these skills could be gained with STEM education, but they stated that lack of knowledge prevents this. Çavaş et al. (2013) stated in their study that learning science meaningfully and developing these skills will be through STEM-based lesson activities. One of the striking points of the study is that the regional situation affects STEM. In fact, most of these problems mentioned by the teachers are expressions that stem from the regional situation. These are the situations that are dealt with regionally in cases such as family indifference and after-school assistance to the family. Karakaya and Avgın (2016) conclude in their study that the education level of the parents affects the students' attitudes towards STEM. Buschor et al. (2014) stated that individuals who feel the support of family members are more interested in STEM fields.

In addition, they emphasized that they experienced problems with STEM education due to the exam system factor. It is also noteworthy that it is a problem to conduct 8^{th}-grade students with STEM education in terms of the high school entrance exam factor, especially regarding the exam. At the same time, it may be a separate research on how much STEM activities will be performed by teachers who are enrolling in science classes even though they do not have their own branch. The teachers stated that these affected the implementation, and they also stated as a result of the study that they were not familiar with the sample projects. Similarly, Siew, Amir, and Chong (2015) stated in their study that STEM activities are costly, schools should be equipped with technological equipment, and school laboratories need science and technology materials to implement their designed products. Demir et al. (2011) stated that there are no laboratories in many schools in our country and that the materials in schools with laboratories are lacking. Eroğlu and Bektaş (2016) stated in their study that teachers experienced problems in STEM-based lessons. Stohlmann et al. (2012), stated that teachers had problems in STEM practices and saw themselves inadequate. In addition, studies have found that professional development is important in STEM education (Apedoe, Reynold, Ellefson, & Schunn 2008). Within the scope of the study, it can be concluded that most of the problems mentioned here are STEM problems throughout the country. The positive aspects of the study were also determined within the scope of the opinions that some teachers tried to process their lessons with STEM education, paid attention to classroom management and ethical principles, and wanted to learn the STEM approach.

Teachers also provided solutions to the problems they stated within the scope of Science, Engineering and Entrepreneurship Practices. It is one of the suggestions that teachers should receive STEM training and that this training should be more practical than theoretical. They emphasized that equality of opportunity and technology should be ensured, attention should be paid to STEM practices, economic inadequacy should not be reflected in the STEM activities of the students, STEM activities should be brought to the level they can do and materials should be provided. In addition, there were some remarkable solution suggestions that the curriculum should be fully identified with STEM education and that the physical conditions of schools should coincide with STEM, which is the requirement of the age. Similarly; STEM education should be widespread both in schools and in activities outside of school (Yamak et al., 2014), teachers need education covering science and engineering applications (Sarı & Yazıcı, 2019), and that the infrastructure such as financial, human and planning should be sufficient for STEM activities to be efficient. (Thibaut et al., 2018) stated that teachers should develop materials related to science subjects through the engineering process (Marulcu & Sungur, 2012). In addition, Bers and Postmore (2005) draw attention to the necessity of teaching new approaches, methods and techniques to teachers in their studies.

CONCLUSION

This study aimed to determine the competencies of science teachers in Science, Engineering and Entrepreneurship Practices, the problems they experienced in the face of the application and the solution suggestions for those. The results obtained in this context are presented below, taking into account the notable factors.

Science teachers' STEM awareness levels are sufficient regardless of gender and professional seniority. Similarly, it was observed that science teachers were highly positive in their Entrepreneurship skills, without being affected by the variables of gender and professional seniority. Therefore, it can be said that teachers' awareness of both STEM education and Entrepreneurship skills is sufficient for science, engineering and entrepreneurship practices. However, the lack of applied in-service training, the intensity of the curriculum, the lack of materials and exam anxiety, and the learning cultures of students for STEM education have emerged as problems that reduce the efficiency of science, engineering and entrepreneurship applications. On the other hand, designing learning environments in accordance with STEM applications, supporting the content of the curriculum in performing STEM activities, and providing practical vocational training draw attention as solution suggestions.

Limitations and Future Research

This study reflects teachers' experiences and competencies in a limited area as professional experience. Within the scope of Science, Engineering and Entrepreneurship Practices, science teachers should be given training within the scope of the STEM approach and how they can implement STEM with the opportunities in their region. Since the workshop knowledge and application skills of STEM applications are required, teachers should be trained on this subject. Teachers should be informed about how to apply science teaching with STEM. In order for teachers to adopt the STEM approach, regional opportunities to participate in projects and studies should be expanded. In future studies, teachers with higher seniority years can be worked within the scope of STEM education. Within the scope of the effect of regional situations on STEM, different qualitative studies can be conducted that adopt the views of students. Studies in which teachers' opinions are taken to investigate the effect of the situation of schools on STEM application can also be conducted.

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