

POST-STEM EDUCATION VIEWS OF SECONDARY SCHOOL STUDENTS IN NORTHERN CYPRUS

VISÕES DA EDUCAÇÃO PÓS-STEM DE ALUNOS DO ESCOLAR SECUNDÁRIO NO NORTE DE CHIPRE

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ABSTRACT

The main aim of this research is to determine the opinions of secondary school students in the Turkish Republic of Northern Cyprus after the STEM Education Course. A qualitative research model was applied in the study. The study group of the current research consisted of a total of 20 secondary school students aged 12 years. A semi-structured interview form was used as the data collection tool. The obtained data were categorized into themes and interpreted. The NVIVO-12 program was used to analyze the data and model the resulting situation. The findings obtained as a result of the research were discussed with the relevant literature. According to the data, as a result of the research were discussed with the relevant literature. As a result of the analyzes, it was concluded that after the STEM education course, the students developed their skills, that they should be given in their schools and that it benefited them. In line with the results obtained, suggestions were made on STEM applications.

Keywords: Northern Cyprus, STEM Education, Student opinions, Case Study.

RESUMO

O principal objetivo desta pesquisa é determinar as opiniões dos alunos do ensino secundário na República Turca do Norte de Chipre após o Curso de Educação STEM. Um modelo de pesquisa qualitativa foi aplicado no estudo. O grupo de estudo da presente pesquisa foi composto por um total de 20 alunos do ensino médio com idade entre 12 anos. Foi utilizado um formulário de entrevista semiestruturada como instrumento de coleta de dados. Os dados obtidos foram categorizados em temas e interpretados. O programa NVIVO-12 foi utilizado para analisar os dados e modelar a situação resultante. Os achados obtidos como resultado da pesquisa foram discutidos com a literatura pertinente. De acordo com os dados, os resultados da pesquisa foram discutidos com a literatura pertinente. Como resultado das análises concluiu-se que após o curso de educação STEM os alunos desenvolveram suas competências, que deveriam ser ministradas em suas escolas e que isso os beneficiou. Em linha com os resultados obtidos, foram feitas sugestões sobre aplicações STEM.

Palavras-chave: Chipre do Norte, Educação STEM, Opiniões dos estudantes, Estudo de caso.

Introduction

The success of nations in various fields is closely related to their adaptation to innovations. In other words, nations should closely follow the innovations in scientific and technological aims. Innovations in technology and science increase the demand for skilled manpower. Nowadays, there is a need for entrepreneurial individuals who can think creatively, pay attention to details, have advanced problem-solving skills, question, desire to research and learn, and make the right decisions (Thomas, 2014). In the changing, developing and renewing modern world, information is increasing day by day. With increasing knowledge, various methods and techniques are used to transfer this information to individuals in a healthy way. The newest of this in today's age is STEM education.

If we explain STEM education, it is called as teaching students at the end of an effective and successful teaching process by integrating science and science, technology, engineering and mathematics courses with each other (Meng, Idris, & Kwan, 2014). According to researches, It is stated that STEM is derived from the first letters of the concepts of science (science), technology (technology), engineering (engineering) and finally mathematics (mathematics) and includes one of these concepts in today's educational institutions. The focus of STEM or FeTEMM education, as it is called in our language, is to provide learners with the knowledge

and abilities required in both mathematics and science courses in the light of 21st century disciplines (Çorlu and Aydın 2016).

As in many countries, STEM approach is researched from pre-school to university in Turkey and its effectiveness is tried to be revealed (Aşık, Doğança Küçük, Helvacı & Corlu, 2017; Eroğlu & Bektaş, 2016; Gülhan & Şahin, 2016). As a result of the literature review, Öznacar and Dericioğlu (2017) revealed in their study the barriers in terms of physical and technological infrastructure that school administrators who work in public schools in Northern Cyprus encounter in schools. If we look at the works in the Turkish Republic of Northern Cyprus, we can see that a new work has started. Dericioğlu and Öznacar (2020) received the opinions of school administrators in Northern Cyprus on the implementation of stem education in Northern Cyprus. In addition, significant differences emerged as a result of the tests applied to 12-year-old students before and after the STEM education held in Famagusta Campus of Istanbul Technical University Northern Cyprus (Dericioğlu, Öznacar, & Köprülü, 2022). However, increasing studies in the related field is undoubtedly extremely important.

Objective of the Research

The objective of this study, when we look at the studies conducted in the Turkish Republic of Northern Cyprus (TRNC), it has been seen that the studies on STEM education are quite limited. Therefore this research purpose, “What have the views of Northern Cyprus Secondary School students after the STEM Education Course?” An answer to the research question was sought.

Methodology

Research Model

In this study, qualitative research methods will be used. Qualitative research can be defined as revealing natural events as a whole and analyzing from specific to general (Demirli, 2007). Case study, one of the qualitative research models, was

preferred in our research. Case study; It can be defined as the method in which more than one event, environment, program, social group or interconnected systems are examined (Mc Milan 2000; Büyüköztürk, 2017).

Study Group and Sampling

The study group of the research determine the opinions of the students sent to STEM education, the study group of the research was composed of 12-year-olds who were educated in Bekir Paşa High School, Canbulat Freedom Secondary School, Doğa College and Girne English Schools in the 2018-2019 academic year. It consists of 20 secondary school students. The students are 19 boys and 1 girl.

Purposeful sampling, one of the qualitative sampling methods, was chosen in this study. Purposeful sampling is preferred to increase the credibility of the research conducted with the aim of reaching rich data. In this study, snowball sampling, which is one of the purposeful sampling types, was used. It refers to the process of selecting a person related to the subject of the research as a reference, reaching other people through this person and obtaining the necessary information. Participants participating in the research direct the researcher and in this context, the sample expands (Noy, 2008).

Data Collection Tool

In our research, the interview technique, which is one of the qualitative data collection tools, was used. In the study, an interview form prepared by the researchers was used in order to determine the students' views after the STEM course and to reveal their perspectives on the applicability of the STEM education model in TRNC. In the interview form, besides the questions about demographic information prepared to obtain student information of school, 5 open-ended questions were included in order to determine their views after the STEM course and to reveal the perspectives on the applicability of the STEM education model in TRNC.

The education management field, two experts from the Turkish language field and one expert from the assessment and evaluation field. Experts were asked

to evaluate the questions as 3 (appropriate), 1 (partially appropriate) and 1 (not appropriate) in terms of content, understandability and expressiveness, and to indicate their suggestions on the questions. The average of the evaluations of the experts was found to be 4. As a result of the expert opinions received, it was determined that the interview form was suitable for use in research. The questions were finalized by taking into account the suggestions of the experts.

Collection of Data

The data of the study were collected through interviews conducted by researchers in the 2018-2019 academic year by reaching out to students post of the STEM education course. The interviews took place in August. The interviews were conducted with one-to-one interviews when both researchers and students were available. One-to-one interviews with students in classrooms on the specified dates were recorded with a tape recorder.

Analysis of The Data

Qualitative data analysis was applied in the interview, one of the data collection tools used in this study. The most preferred way to analyze data in qualitative studies is to perform data analysis simultaneously with data collection (Merriam, 2013). In the analysis of the data, descriptive analysis of the data obtained in the study was used. Kümbetoğlu (2005) in order to make a descriptive analysis, it is aimed to make a descriptive analysis based on the words, expressions, the language used, the structure and features of the dialogues used in qualitative analysis, the symbolic expressions used and analogies.

While transcribing the interviews, each speech was transferred as it was heard, without any correction and in the interviewer-interviewee order. The answers obtained from the research were collected under themes by analyzing content. The analysis of the data was carried out by collecting the answers given by the students to the questions under themes and sub-themes and expressing the number of students who gave the answers for each theme.

Stages of Application

This study was completed for 8 hours a day for 10 days in the 2018-2019 academic year. The STEM training course was given by 1 expert in the field of STEM, hosted by at the Famagusta Campus of ITU. Within the scope of this study, the experimental group was primarily informed about "What is STEM? five-step process". Then, "egg breakage problem, unbreakable egg design, egg car design, 2 marble running, marble running design, energy transfer with marbles, marble race in liquid, kinetic sculptures, gears in kinetic sculptures, kinetic sculpture design, 4 bridges, Da Vinci bridge, suspension bridge design, if there is a cliff in front of us, what is a zipline? for what purpose is it used? "Wind-powered zipline design, science show" activities were organized.

Results

Table 1 – Distribution of Institutions and Schools

Structure of Institution	N	%
Private	10	50
Public	10	50
School of Participants		
Canbulat Secondary School	1	5
Polatpaşa High School	1	5
GMTMK	4	20
Doğa College	8	40
Çanakkale Secondary School	4	20
English School of Kyrenia	1	5
Bekir Paşa High School	1	5

As seen in Table 1, According to the data obtained, 50% of the participants are studying in public institutions, while 50% are in private institutions. 5% of the participants continue their education at Polat Paşa High School, 20% at Çanakkale Secondary School, 5% at Bekir Paşa High School, 5% at English School of Kryneia, 40% at Doğa College, 5% at English School of Kyrenia, 20% at GMTMK,

Table 2 – Findings Regarding the Benefits of STEM Education for Students

THEMES	N	%
Students have used science and technology	6	20
Students have a chance to make the experiment in STEM class	8	30
Students have used thinking and creativity skills. Also students had the opportunity to work as a team.	8	30
Students have a chance to meet engineering aims in STEM class	6	20

As seen in Table 2, it consists of 4 themes. According to research students defined they expressed their opinion that they learned to create and design beautiful different products using science and technology, that they learned to think and create processes of design, planning and improvement, and that they developed their skills in the field of engineering. On the other hand, students stated that they learned to think and create the design, planning and improvement processes. Finally, other participants expressed their opinion that they believe that my engineering skills have improved.

Table 3 – Findings Regarding the Evaluation of Acquisitions in Science and Science at the End of STEM Education

THEMES	N	%
Students have a chance to observe experiments in STEM class	10	50
Students have a chance to make the experiment in STEM class	10	50

As seen in Table 3, Most of the students stated the majority of them expressed that they had the opportunity to experiment with their teachers and observe the experiments, and that they had different experiences and that they also improved themselves in understanding the concepts.

Table 4 – Findings Regarding the Evaluation of the Achievements in the Field of Engineering at the End of STEM Education

THEMES	N	%
Students have got a chance to development and advancement in engineering skills in STEM class	10	48
Students have got a chance to develop and advancement in design skills in STEM class	8	34
Students have got a chance to develop planing skills in STEM class	4	18

As seen in Table 4. According to the research, students defined that they gained knowledge and skills related to engineering by exploring the field of engineering, and they expressed that they learned to design and produce the best product with the least material use by using the engineering field.

Table 5 – Findings Regarding the Evaluation of Achievements in Mathematics at the End of STEM Activities

THEMES	N	%
Students have thought Mathematics very important in STEM class	12	60
Students have a chance to improve measurement and calculation skills in STEM class	8	40

As seen in Table 5. According to the research, students defined that they benefited from the field of mathematics in STEM studies. Other participants expressed their opinion that my skills such as measurement and calculation have improved in STEM studies.

Table 6 – Findings on the Evaluation of the Combined Use of Science, Technology, Engineering and Mathematics

THEMES	N	%
Students have thought that the use of 4 fields together is educational and instructive.	16	80
Students have thought STEM education is enjoyable	2	10
Students have a chance to teamwork skills in STEM class	2	10

As seen in Table 6. According to the research, students defined that when the fields of Science and Science, Technology, Engineering and Mathematics are applied together, it is fun and beautiful and also provides the opportunity to do teamwork. Other Participants, on the other hand, expressed their views that they demonstrated their design skills and gained engineering skills. Another participant stated that the STEM education approach is enjoyable, educational, instructive and brings creativity.

Table 7 – Findings Regarding Which Field is Used More at the End of STEM Education

THEMES	N	%
Engineering field	10	50
Science field	2	10
Technology field	4	20
Mathematic field	4	20

In Table 7, According to the research, students defined the majority of them thought that the engineering field was used more, while the other participants stated that the mathematics field was used more. Looking at the table, the participants stated that they thought that the field of science was used less, while the other participants stated that the field of technology was used more.

Table 8 – Findings Regarding Students' Views on Teaching STEM Courses in Schools

THEMES	N	%
According to students, STEM courses should be given by the Ministry of Education in schools	20	100

In Table 8, According to the research, school administrators defined have a positive opinion about giving STEM lessons to them in the schools

Discussion

According to the findings of the study, STEM education process, they expressed their views that they learned to create and design beautiful different products using science and technology, to work as a team, to think about planning and improvement processes, and finally to develop their skills in the field of engineering. When looking at the literature, Akdağ and Güneş (2017) stated that the students' creativity improved with the solutions they came up with with STEM applications, and they were successful by sharing the work in the face of difficulties with group work.

Supporting student views, Wendel (2008) states that students who are faced with a design problem related to real life acquire the basic concepts and skills related to science in communication with their peers in the process of solving the problem, thus they realize the place of the concepts they learn in real life situations. This is almost the same in research and literature, but in this study, the participants emphasized their engineering skills.

The majority of the students participating in the research stated that they had the opportunity to experiment with their teachers in the field of Science and Science and to observe the experiments, and that they had different experiences and that they also improved themselves in understanding the concepts. Looking at the literature, Altan, Yamak, and Kırıkkaya (2016) state that in the study they conducted with pre-service science teachers, their motivation increased positively. In the study conducted by Yamak, Bulut, and Dündar (2014), it was stated that the effect of STEM

activities on the science process skills and attitudes of secondary school 5th grade students positively improved their attitudes towards science and their scientific process skills.

The students participating in the research stated that they think that they have gained technology-related gains and that they can transform their products into easier and higher quality designs by making use of technology. In addition, the participants stated that they did not gain technology-related gains. Looking at the literature, Stohlmann, Moore, and Roehrig (2012) stated that as well as using experimental kits for students, even a very simple material such as a board can be used, so that students will be able to understand that technology can be developed not only with electronic materials, but also with ordinary materials.

Participants in this research stated that they gained knowledge and skills in engineering by exploring the field of Engineering, and learned to design and produce the best product with the least material use. If we look at the studies in the literature, Akdağ and Güneş (2017) stated that some of the students who participated in STEM applications stated that their thoughts on Engineering did not change, while the other part stated that their thoughts on Engineering changed in a positive way. Tseng, Chang, Lou, and Chen (2013) stated in their study that students' interest in STEM fields increased with STEM education, and the reason why a few of the students changed their thoughts towards Engineering is considered to be the effect of the students' families and social environments.

Participants in the research expressed that they benefited from the field of mathematics in STEM studies. Other participants expressed their opinion that my skills such as measurement and calculation have improved in STEM studies. Another participant stated that he did not benefit from mathematics. When we look at the studies in the literature, Karakaya, Avgın, and Yılmaz (2018) determined 611 students studying at the 6th, 7th and 8th grade levels of secondary school as a sample in the study prepared to determine the interests of students in STEM professions in terms of different variables. As a result of the research, it was concluded that the level of interest of the 6th grade students was higher than the other grade levels, especially in the field of mathematics.

Participants in the research stated that when the fields of Science and Science, Technology, Engineering and Mathematics are applied together, it is fun and beautiful and also provides the opportunity to do teamwork. He also stated that he showed his design skills, gave him engineering skills, was educational, didactic and gave creativity. When the literature is examined, it is seen that the studies have obtained similar findings. In the research conducted by Yasak (2017), in the interviews they made with the students, they stated that the lessons became more fun thanks to STEM applications, they provided more permanent and effective learning, and they could exchange ideas with their peers through group work. At the end of the whole process, it was understood that the attitudes of the students towards the lesson revealed a positive and significant difference compared to their previous attitudes. According to Ensari (2017), he investigated the views of physics teacher candidates on STEM activities and STEM education in his master's thesis. As a result of the research, pre-service teachers emphasized that STEM activities make the lesson more interesting and fun, ensure active participation in the lesson, make the learning more permanent, and that such activities make the lesson topics more understandable.

As a result of the study conducted by Aydın and Bayderel, (2019), STEM activities were found in students; It has been determined that it contributes to 21st century skills such as cooperation, critical thinking, problem solving, creativity and self-confidence. In Yıldırım and Selvi (2018), students were asked for their opinions on the benefits of STEM applications. Students stated that it provides many benefits. They stated in their opinion that these benefits enable learning by doing-living, the subjects learned allow connection with daily life, facilitate the teaching of lessons, increase academic success and provide permanent learning.

According to this research, at the end of STEM education, secondary school students, when asked which of the fields of Science and Science, Technology, Engineering and Mathematics are used more, most of them think that the field of engineering is used more, while the other participants put forward their opinions that the field of mathematics is used more. This research and studies in the literature show almost similarity.

According to this research, they stated that STEM lessons would be good for the participants to be given in their schools, to develop their creativity, to learn to plan, to socialize and to perform teamwork. If we look at the studies in the literature, Akgündüz and Ertepinar (2015) argued that STEM applications should be applied in schools at an early age in order for Turkey to compete with other countries and to develop. Thus, they also stated that 21st century skills such as engineering research, inquiry, creativity, critical and analytical thinking, decision making and problem solving, which are STEM fields, will be gained at an early age. In another study, Timur and İnançlı (2018) stated that with the renewal of the curriculum, the existence of STEM education should be adapted to this in schools. In addition, they stated that the information is permanent and individuals will keep up with the lives of the students.

Conclusion

According to the research, students have thought that they have gained technology-related gains, they can transform their products into easier and higher quality designs by making use of technology.

Another result of the research shows; students stated that they gained knowledge and skills about engineering by exploring the field of engineering, and learned to design and produce the best product with the least material use.

According to the research, students stated that they benefited from the field of mathematics and that their skills such as measurement and calculation were improved.

Another result of the research shows; students have benefited from the field of science and science.

According to the research, students have stated that had the chance to work as a team with STEM education.

Another result of the research shows; students have said that the engineering field is used more.

According to the research, STEM courses should be given by the Ministry of Education in schools.

Recommendations

In line with the findings of the research, the following recommendations are presented:

STEM applications should be included at all levels from pre-school to higher education by the Ministry of Education.

STEM courses for teachers should be organized by the Ministry of Education.

STEM education summer schools should be organized regularly for high school and secondary education by the Ministry of Education.

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