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The Effect of STEM Education on the Pre-school Pre-service Teachers' Lifelong Learning Tendencies

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ABSTRACT

The research aims to explore the effect of STEM education on pre-service teachers' lifelong learning tendencies. 22 pre-service teachers studying in the 4th grade participated in the research. The research was carried out within the scope of the STEM education elective course given in the pre-school teaching department in the faculty of education. A methods approach was employed in the research. In the research, in which the explanatory mixed design was applied, the quantitative data were collected with the Lifelong Learning Tendency Scale. Qualitative data were obtained with a semi-structured interview form. At the end of the study, it was determined that STEM education had a positive effect on the pre-service teachers' lifelong learning tendencies and developed their lifelong learning skills. It was found, with STEM education, that producing machines, robots, and vehicles with simple materials contributed to their seeing the materials around them with different eyes and their desires to learn and produce new things. It was also stated that they contributed to self-directed learning, increased their willingness to explore and research, and activated their learning by doing and experiencing skills. It was concluded that they enjoyed doing the activities, which made the information permanent and created their desire to use these activities in their lessons in order to create fun and permanent learning environments in the future.

Keywords: Education, lifelong learning, lifelong learning tendency, pre-school teacher candidate, STEM

STEM Eğitiminin Okul Öncesi Öğretmen Adaylarının Yaşam Boyu Öğrenme Eğilimlerine Etkisi

Bilgi
**Sorumlu yazar*

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ÖZ

Bu araştırmada STEM Eğitiminin Okul Öncesi Öğretmen Adaylarının yaşam boyu öğrenme eğilimlerine etkisinin araştırılması amaçlanmıştır. Araştırmaya 4. sınıfa devam eden 22 öğretmen adayı katılmıştır. Araştırma eğitim fakültesi bünyesinde Okul Öncesi Öğretmenliği bölümünde açılmış olan STEM Eğitimi seçmeli dersi bünyesinde yürütülmüştür. Araştırmada karma araştırma yöntem kullanılmıştır. Açıklayıcı karma desenin kullanıldığı araştırmada nicel veriler, Yaşam Boyu Öğrenme Eğilimi Ölçeği ile toplanmıştır. Nitel veriler ise yarı yapılandırılmış görüşme formuyla elde edilmiştir. Çalışmanın sonucunda; STEM Eğitiminin Okul Öncesi Öğretmen Adaylarının yaşam boyu öğrenme eğilimleri üzerine olumlu etkisinin olduğu ve yaşam boyu öğrenme becerilerini geliştirdiği saptanmıştır. STEM Eğitimi ile basit malzemelerle makine, robot ve araç üretmelerinin onların çevrelerindeki malzemeleri farklı gözle görmelerine ve yeni şeyler öğrenme ve üretme isteklerine katkı sağladığı tespit edilmiştir. Ayrıca öz yönetimli öğrenmeye katkı sağladığı, keşfetme ve araştırma yapmaya isteklerini artırdığı, yaparak yaşayarak öğrenme becerilerini harekete geçirdiği belirtilmiştir. Etkinlikleri yaparken zevk aldıklarını ve bunun da bilgiyi kalıcı hale getirdiğini, ileride eğlenceli ve kalıcı öğrenme ortamları oluşturmak adına derslerinde bu etkinlikleri kullanma isteklerini oluşturduğu sonuçlarına ulaşılmıştır.

Anahtar Kelimeler: Eğitim, yaşam boyu öğrenme, yaşam boyu öğrenme eğilimi, okul öncesi öğretmen adayı, STEM

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Introduction

The concept of lifelong learning was first put forth by John Dewey and Eduard Lindeman in 1920 (Ulutaşdemir, Tabak, Deveci and Öztürk, 2011). Lifelong learning is a process that continues from cradle to grave covering the entire life cycle. All of the learning activities that the individuals continue throughout their lives and consist of even the learning at school are called as lifelong learning (Bağcı, 2011). Aspin and Chapman (2000) define lifelong learning as a supportive process that increases and strengthens the knowledge, values, skills and understandings that people gain throughout their lives and enables them to apply them in real life. In addition, it is defined by the European Commission (2000) as the whole of learning that continues in every moment of life, which is necessary to exist in social and economic life, together with gaining knowledge, gaining experience and acquiring various skills. According to the OECD (1996) report, lifelong learning is referred to as the learning process that consists of formal education, non-formal education and unplanned education. It considers the process to be carried out to gain lifelong learning as an approach. According to this approach, all the materials, methods and techniques relevant to learning and teaching in an education program are different compared with the traditional education approach. Accordingly, Garner (2002) defines the content of the education understanding in which lifelong learning is realised as follows: Education is not only the transfer of the knowledge but a lifelong dynamic process that aims to acquire the knowledge and skills that will make the individual's learning permanent, and that allows individuals to choose the most appropriate teaching styles for them. The World Bank (2003) describes lifelong learning as a process, in which the needs, wishes and abilities of individuals are taken into account, the learner is at the forefront in teaching, and teachers have a role not only in transferring knowledge but also directing and developing knowledge. Accordingly, how much STEM education supports this education process has been investigated in this study. That is, it was aimed to explore the effect of STEM education given to the pre-school pre-service teachers on their lifelong learning tendencies.

STEM education is a new education understanding and has a different education system that aims to teach the science, mathematics, engineering and technology fields by integrating them (Sanders, 2009). The student not only acquires knowledge and experience in a single field but also faces the process of associating, transferring, using and making sense of the acquired knowledge with other fields (Bee 2010; Çakır and Yalçın 2019; Çiftçi and Topçu 2021). This provides students to have permanent and significant learning experiences in which they are responsible for their learning (Çevik, Danıştay and Yağcı, 2017). The individual realises his/her learning with his/her learning speed and learning style and makes his/her cognitive coding. The teacher's role here is to learn with students and to guide and direct students (Aydoğan Yenmez et al. 2021). STEM education provides to uncover and develop the students' skills and abilities by supporting them (Becker and Park, 2011; Çakır and Yalçın 2020). Thus, the individual tends to learn more by experiencing the self-confidence and joy of revealing her/his mental power, to be willing to learn and to develop what s/he has learned, that is, to maintain it. In addition, it was determined that it developed the students' characteristics that were described as 21st-century skills (Çetin and Kahyaoğlu, 2018). The 21st-century skills are the cognitive, affective and communicative skills for the individual to adapt to society (Partnership for 21st Century Skills 2009). All of the 21st skills are related to lifelong learning (Gvaramadze, 2007), in addition, the 21st-century skills consist of the skills and competencies that are necessary for lifelong learning (Van Laar et al., 2017). Furthermore, there is a significant relationship between the teachers' lifelong learning tendencies and the 21st-century teachers' skills. Accordingly, when there is an increase in teachers' lifelong learning tendencies, there will also be an increase in the 21st-century teachers' skills (Kozikoğlu and Altunova, 2018).

Lifelong learning is a feature that should be in the 21st-century human model. To internalise lifelong learning, schools, naturally, teachers, have a great responsibility. Teachers should have these competencies to fulfil this task (Yaman ve Yazar, 2015). As teachers will educate the individuals who have this feature, teachers should have this feature at first. Teachers should be educated in learning to learn, continuous learning, self-development in their pre-service period (Günüç, Odabaşı and Kuzu, 2012; Samur and Yalçın 2021; Yılmaz, 2016). When the teacher starts her/his profession, s/he should act selflessly to improve and renew him/herself. To provide this, they should take useful training in pre-service and in-service continuous learning and lifelong learning (Altun Yalçın, 2019; Kazu and Erten, 2016). In the face of these deficiencies and needs, countries have started to use various teaching methods and approach to raise individuals who can produce knowledge and the knowledge taught by making innovations in their education systems (Çavaş, 2011). These new approaches come forth thanks to the STEM education and Montessori approach consisting of several fields and skills. In the literature, providing STEM experiences to pre-school children will contribute to the permanence of the learned knowledge, lifelong learning, and the training of individuals who will help economic development. For this reason, pre-school teachers should receive pre-service training in this field and thus their lifelong learning should be supported (Aronin & Floyd, 2013; Dejarnette, 2012). The present study aims to explore the effect of the STEM education on the development of the pre-school pre-

service teachers' lifelong learning tendencies. In addition, it is aimed to examine the pre-service teachers' thoughts about the STEM and contribute to their graduations as an expert in these fields.

The study's limitations were limited to pre-service teachers studying only in the pre-school department, as it is closely related to the purpose. In addition, due to time and cost, only the university in the city where the researcher is located was taken. Another limitation is that four experts only approved the semi-structured interview form prepared by the researcher in the study in the field of science and mathematics education during the reliability determination phase. Additionally, they have not received any training in STEM education.

Method

Research Model

In the study, the explanatory design which is one of the mixed method types was used. The mixed-method researches consist of the researcher combining qualitative and quantitative methods, approaches, and concepts within a study or in successive studies (Fraenkel, Wallen and Hyun, 2012). The explanatory design includes two stages. Here, the quantitative data were collected first and analysed. Then, the qualitative data were obtained to explain and investigate the quantitative data. That is, this design is more useful in the cases in which the researcher wants to explain the important, unexpected or surprising results in detail in her/his quantitative study with qualitative data (Creswell and Plano-Clark, 2007). As the study group model, a single group pre/post-test model was created. This group design is to compare the effect of the procedure applied for a group with the pre-test and post-test scores (Cohen, Manion Marison, 2007). On the other hand, the qualitative data were obtained with the questions prepared to explain the quantitative data considering the purpose of the Lifelong Learning Tendency Scale and its sub-dimensions. While the questions were being prepared, the scale items collected under each sub-dimension were analysed one by one. It was focused on which characteristics of pre-service teachers were trying to reveal and what they aimed at. The questions asked to collect the qualitative data and the sub-dimension relationship of the Lifelong Learning Scale are presented below.

The questions “Do you think the STEM education with simple materials contribute to your personal development? Why? How?" and "Have you gained new information during the STEM education with simple materials? How?" were associated with the “motivation” sub-dimension;

The question "Do you think the STEM education with simple materials have contributed to your gaining new skills? Why? How?" with "perseverance" sub-dimension;

The question “Do you want to apply the STEM education with simple materials in your courses? Why? How?” with “lack of regulating learning” sub-dimension;

And the question “Do you want to get advanced STEM education with simple materials? Why?” with “lack of curiosity” sub-dimension.

Research Universe and Sample

The reachable universe and purposeful sampling method were applied in the research. The purposeful sampling enables the researcher to reach important information sources about the subject, event or phenomenon to be researched and provides an opportunity to examine the situations that are desired to be investigated in depth (Teddlie and Yu 2007). The research sample consists of 22 pre-service teachers studying at the department of pre-school teaching in the faculty of education of a state university located in the Eastern Anatolia Region in the 2019-2020 academic year. The data were collected in the STEM education course which was an elective course in the department of pre-school teaching in the faculty of education. Before the research was started, it was determined that the pre-service teachers had not taken any course related to STEM Education. The STEM education with simple materials was given to the pre-service teachers for 14 weeks. The activities were performed with the materials which they regard as waste around themselves. These materials are pad bottle, pad bottle cap, used CD, cardboard, mousetrap, tin can coke, empty can, abesland stick, pipette, etc. They were directed to build machines, robots, motor, vehicles, etc. many operating (motorised) and non-operating (non-motorised) systems with materials.

Lifelong learning tendency scale knowledge

The scale, which consists of 27 items was developed by Diker Coşkun (2009). The scale is in the form of ratings and consists of 6-point Likert type items. The Cronbach alpha inner consistency coefficient of the scale was found as 0,89. The motivation and perseverance items, which are the two first sub-dimensions consist of positive items; the last two sub-dimensions as lack of regulating learning and lack of curiosity, are the dimensions consisting of negative items. Considering this situation, the items of the last two sub-dimensions were reversed and scores were made in the analysis of the scale items. In the present study, this reliability was found as 0,86.

Process

Before the application process of the research, necessary research and literature reviews were held related to including the features of STEM education and including the level of excitement for the characteristics that are required to be measured in preschool pre-service teachers can create new designs by using their field knowledge. In addition, it was taken into consideration that the pre-service teachers be qualified to solve the problems they would encounter in the activities with the experience and knowledge they had gained from the previous activity and that they were at a level that they would use in their professional life and personal development throughout their lives. The materials in the

activities consisted of the simple materials that can be found in each area of daily life and appropriate in terms of cost (such as pet bottle-cups and lids, straws, cardboard boxes, insulating cables, tin cans). STEM applications that continued for 14 weeks in total, 2 hours per week, were held with the 22 preschool pre-service teachers under the guidance of an expert in the field.

In this process, it was tried to help the preservice teachers to remove their prejudices towards the solution of the problem they encounter in daily life, to develop their lifelong learning and creativity skills, to gain different perspectives, to connect the information they had learned with their daily life situations, and to provide the selfconfidence that they can design their products. Before starting these applications, the theoric information about the STEM education was presented to the pre-service teachers in presentations. Then, they were asked to create groups consisting of four participants most to perform the activities that had already been prepared. The pre-service teachers were asked to prepare the activity by giving the theoric information (such as science and mathematics information that were necessary, visualization of the activity that would be applied by drawing) about the problem situation and how to do the last week's activity. In addition, the originality in the activities was taken as the base; that is, it was ensured that the pre-service teachers consulted with the group to produce a solution to the given problem and design the appropriate product not about being put into a certain mould and everyone creating the same product. The techniques used in the activities consist of simple parts (such as plastic bottles-cups and parts, straws, cardboard boxes, insulating cables, tin cans) that are easy and cost-effective to encounter in every area of individuals' daily lives. Activities such as remote-controlled snake, giraffe, non-rolling CD, ship, dancing robot, painter robot and traffic light were implemented by the groups every week. As an example of the activities carried out in line with this information, in the traffic light activity, individuals were given simple materials such as conductive cable, cola cans, LED lights, cardboard, garbage skewers, abeslang, etc. They were asked to produce a working design using their theoretical knowledge such as science, mathematics and technology, and were given the necessary materials such as: Here, individuals collaborate as a group, combine different opinions and information, and try to produce a solution and create a product for a subject in daily life, in line with the materials and time given. Every activity carried out carries certain traces of the previous activity. Thus, individuals make progress by developing new experiences and perspectives by using the experience they gained in the previous activity.

Data Analyses

As the number of the sample more than 30 before the statistical analyses, the quantitative data obtained in the study, Kolmogorov–Smirnov was applied and because the p significance value was found above 0,05, it was found that the data demonstrated normal distribution (p=0,200>0,05) (Can, 2016). As the data demonstrated normal distribution, the correlated samples t-test, which is a parametric test, was applied to determine whether a significant difference was observed between the scores. The purpose of this test is to compare the pre and post-test score averages on the same group (Can, 2016). The content analysis was applied to the qualitative data. For this, different codes and categories were created for each question by gathering the interviews together first. The stages in the content analysis are orderly as collecting the data, determining the categories, arranging-identifying the codes and themes and interpreting the findings (Yıldırım and Şimşek, 2008). The codes and categories created in the stage of validity and reliability of the data analyses were offered to 5 different experts and the results were combined. The qualitative data analysis reliability value was found to be 92%. That the reliability value between the coders was over 70% demonstrated that it was reliable (Arastaman, Öztürk Fidan and Fidan, 2018).

Findings

To explore the effect of STEM education on the pre-school pre-service teachers' lifelong learning skills, the answers of the pre-service teachers to the lifelong learning scale were analysed with the method of statistical analysis. As the number of participants was 22 (can, 2016; if the number of participants is below 30) the Shapiro-Wilk test was considered for the Lifelong Learning Tendency Scale normality test and it was found as pre-test sig.=,942; post-test sig.=,400.

Table 1. Pre-test Scores Descriptive Statistical Findings 184ort he Sub-dimension of the Lifelong Learning Skills Tendency Scale

Pre-tests	Mean	Mode	Median	Std. Deviation	Skewness	Kurtosis
1st sub-dimension	25.85	30	27	5.51	-2.39	7.02
2nd sub-dimension	22.85	21	23	3.10	-.024	-.216
3rd sub-dimension	9.64	6	9.5	3.49	.738	-.236
4th sub-dimension	29.35	30	30.5	6.15	-1.063	1.221

1st sub-dimension: Motivation, 2nd sub-dimension: Perseverance, 3rd sub-dimension: Lack of learning, 4th sub-dimension: Lack of curiosity.

Table 2. Descriptive Statistical Findings Related to the Sub-dimensions of the Lifelong Learning Tendencies Scale Post-test Scores

Post-tests	Mean	Mode	Median	Std. deviation	Skewness	Kurtosis
1st sub-dimension	26	30	28	3.11	-.425	-1.378
2nd sub-dimension	25.92	30	25.5	3.33	.145	-1.807
3rd sub-dimension	11.81	13	15	4.51	-.245	-1.220
4th sub-dimension	35.71	39	37	5.32	-1.047	.934

1st sub-dimension: Motivation, 2nd sub-dimension: Perseverance, 3rd sub-dimension: Lack of learning, 4th sub-dimension: Lack of curiosity.

Table 3. The Paired Samples T-Test Results Related to the Lifelong Learning Tendency Scale

Measurements	N	$\overline{X}$	Ss	T	Sd	P
Pre-test	22	92.27	8.46	-2.565	21	.018
Post-test	22	99.27	10.57			

p<0,05

Table 4. The Paired-Samples T-Test Related to the Sub-Dimensions of the Lifelong Learning Scale

Measurements	N	$\overline{X}$	Ss	T	p
2 pre-	18	23	3.00	-3.556	.002
2 post-	18	26.50	3.36		
3 pre-	20	9.85	3.51	-3.304	.004
3 post-	20	14.2	5.22		
4 pre-	18	30.44	5.95	-2.660	.017
4 post-	18	35.27	6.30		

1: Motivation (Wilcoxon test was applied), 2: Perseverance, 3: Lack of learning, 4: Lack of curiosity

It was determined that it demonstrated normal distribution in these values. The Lifelong Learning Tendency Scale pre-test was found as mean=93; median= 92.27; S.deviation= 8.469; skewness= -0.203; kurtosis= -0.155. The Lifelong Learning Tendency Scale post-test was found as mean=99,27; median= 100; S.deviation= 10,579; skewness= 0,593; kurtosis= 1,283. There are the normality results for the sub-dimensions of lifelong learning below. When Table 1 was analysed, the pre-test normality values related to the sub-dimensions of the Lifelong Learning Tendency Scale are as follows: the pre-test normality Shapiro-Wilk values are orderly as Motivation sub-dimension =,001; Perseverance sub-dimension =,798; Lack of learning sub-dimension =109; Lack of curiosity sub-dimension =,037.

It is seen as a result of the descriptive statistics applied to the pre-test scores related to the sub-dimensions of the lifelong learning tendency scale that, except for the 1st sub-dimension (motivation sub-dimension), the mean, median, mode values of the scores are close to each other in all of the others and the skewness and kurtosis values are between -2 and +2 value range. In the studies carried out, that the kurtosis and skewness values are within the mentioned value ranges indicates that the research data have a normal distribution (George & Mallery; 2001). Therefore, it is accepted that the pre-test results of the lifelong learning scale and the sub-dimensions of motivation, perseverance and lack of curiosity indicate normal distribution.

On the other hand, in the lack of learning sub-dimension, although the mean, median and mode values of the scores are close to each other, it is seen that the skewness and kurtosis values are not between the -2 and +2 value range. In addition, since the significance value of the test used to check the normality assumption was found as less than .05, it is regarded that it does not indicate normal distribution and is subjected to the non-parametric test. If the significance value in the normality test is above .50, it is accepted that the data indicate normal distribution (Can, 2016).

When Table 2 is analysed, the post-test normality values related to the sub-dimensions of the Lifelong Learning Tendency Scale are as follows: the Shapiro-Wilk values are orderly as 1st sub-dimension=,013; 2nd sub-dimension=,019; 3rd sub-dimension=,467; 4th sub-dimension=,151. As a result of the descriptive statistics carried out for the post-test scores related to the sub-dimensions of the lifelong learning tendency scale, it is seen that the score mean, median, mode values are close to each other and the skewness and kurtosis values are between -2 and +2 value range.

In the conducted studies, that the skewness and kurtosis values are between the mentioned values indicate that the research data show normal distribution (George & Mallery; 2001). Therefore, it is accepted that the post-test results of the lifelong learning scale and the sub-dimensions of motivation, perseverance and lack of curiosity show normal distribution. The paired samples t-test results reached between the pre-test and post-test

scores to determine the effect of the STEM education with simple materials on the pre-school pre-service teachers' lifelong learnings are presented in Table 3. In the results of the test, a significant difference was found between the score averages before the activity (pre-test = 92,27) and the score averages after the activity (post-test =99,27) (t21: -2,565; p< 0.05). According to Can (2016), that the significance (p) value is below 0.05 refers to the results providing the significant difference. With this significant difference, it can be claimed that educations ensure positive developments in the lifelong learning skills of the pre-school pre-service teachers. The results of the paired samples t-test applied to determine the effect in the 2nd, 3rd, and 4th sub-dimensions related to STEM education with simple materials on the pre-school pre-service teachers' lifelong learning are presented in Table 4. Among the results, in the perseverance sub-dimension, which is the 2nd sub-dimension, a significant difference was encountered between the pre-education score average (pre-test =23) and the score average after the education (post-test=26,50) (t17: -3,556; p=0,002< 0,05).

In the sub-dimension of lack of arranging learning which is the 3rd sub-dimension, a significant difference was found between the pre-education score average (pre-test= 9,85) and the post education score average (post-test =14,20) (t17: -3,304; p=0,004< 0,05).

In thesub-dimension of lack of curiosity, which is the 4th dimension, a significant difference was found between the pre-education score average (pre-test = 30,44) and the post- education score average (post- test =35,27) (t17: -2,660; p=0,017< 0,05).

When Table 5 is analysed, the Wilcoxon signed ranks test results related to the motivation dimension, which is the 1st sub-dimension of the lifelong learning tendency scale can be seen. The paired samples t-test was desired to be applied to determine the effect between the STEM education with simple materials and the pre-school pre-service teachers' lifelong learning scales' pre-and post-test scores related to the motivation which is the 1st sub-dimension; however, since the pre-test and post-test scores did not demonstrate normal distribution, the Wilcoxon signed ranks test, which is the non-parametric equivalent of this test, was applied. Significant difference was not encountered between the pre-test and post-test scores of the motivation dimension of the pre-service teachers (Z = -1,330; p=,184 > ,05).

Qualitative Data

The codes and categories were created according to the pre-school pre-service teachers' answers to the open-ended questions and presented in Tables.

When Table 6. is analysed, the answers of the pre-service teachers emerged as 2 categories and 2 codes as "I thought that it would contribute to my personal development" and "I thought."

In these categories, the pre-service teachers stated that they had never heard of STEM Education before and that they had no information related to it. Those, who had information, stated that they could not do some simple operations such as coding, making motors and soldering, they could not do it, they would not be able to obtain a product, and they were worried about this. In addition, they claimed that they found STEM Education difficult, distant from them and that they were interested. In addition, they stated that everyone should get this education, it will be useful, it will enable them to produce new things, they will use it in their professional life, it is necessary, they are curious and they regard themselves as insufficient in this sense. After taking the STEM Education, it was determined that all of the pre-school pre-service teachers thought that taking STEM Education contributed to their personal development, and their answers consisted of 2 categories and 8 codes. The pre-service teachers stated that the education developed their creativity, that they started to produce new, different and creative materials, it improved their perspectives and they gained the ability to look at materials and technology from a different point of view. In addition, they claimed that they found the STEM education useful, thought that it contributed to personal development, developed the sense of competence, increased confidence in doing things, as they thought that they would be useful to students with fun activity researches, they started to research fun activities that include simple motors for students. They claimed that the STEM education developed their creativity, contributed to their solution producing skills, thus, they could create different and creative materials, produce useful products by using materials from daily life, develop their points of view by looking at the materials and lessons from different perspectives and their negative thoughts changed. In addition, they stated that creating different products, made the working system of the machines understandable and helped to make a robot and robotic coding. In addition, with useful activities, they claimed that it increased the desire to do it on their own and that it was a model that could be used to attract students' attention to the lesson. Moreover, they preferred that it included the contents that can be applied, that they had the curiosity to the STEM education, that taking this education had some advantages, that it became a more important lesson, that they used to get bored while putting out products, but now the products give pleasure.

Thoughts before taking the training;

…"I thought it would contribute, but I had no idea how exactly it would contribute as I had not seen it before."

…"I had no idea before I got the training."

…"Before I took STEM education, I had a short knowledge, but my knowledge about the application forms and personal benefits was limited."

… "I didn't even know there was such an education."

…"I didn't know anything about STEM education."

Thoughts that occur after receiving the training;

…"I already thought it contributed, and it personally contributed to my ability to look for new solutions in various processes and not to think more theoretically and functionally when I encounter some problems in daily life."

…"After my education, I began to think that it was advancing me daily in science, mathematics and technology. I realized that there was an improvement in my personal development with the activities I did during the course."

…"Respect for ideas and assertiveness, individual curiosity, research and self-confidence made me look at error more realistically. I can see things from a wider and different perspective. I look more creative."

…"Different methods do contribute to learning and productivity."

…"Yes, I think it contributes to personal development. Because STEM education improved my self-expression and active skills."

Table 5. The Wilcoxon Signed Ranks Test Results Related to the 1st Sub-Dimension of the Lifelong Learning Tendency Scale

Measurements	Ranks	N	Average rank	Rank Total	Z	p
Motivation post-test - Motivation pre-test	Negative ranks	6	8.08	48.50	-1.330	.184
	Positive ranks	11	9.50	104.5		
	No difference	4				

1st sub-dimension: Motivation

Table 6. Do You Think STEM Education With Simple Materials Contributes To Your Personal Development? Why? How? What Are Your Thoughts After Taking STEM Education?

Before the education			After the education		
Category	**Code**	**Frequency**	**Category**	**Code**	**Frequency**
Affective	bias	11	Affective	willingness to do it yourself	1
	Not interested	1		Attract attention to the lesson	2
Cognitive	Be curious	1	Cognitive	Searching fun activity	8
	Useful	6		Entertaining science course	6
	Not useful	7		Being useful	31
	Have no information	5		Creating a product	6
	Have no thought	2		the working system of machines	2
	Activity with waste materials	2		Other	12
	A new model	1			
	Being popular	1			

Table 7. Did you gain new information during the STEM education with simple materials? Why? How? What are your thoughts before and after the STEM Education?

Before the STEM education			After the STEM education		
Category	**Code**	**Frequency**	**Category**	**Code**	**Frequency**
Cognitive	Thinking	17	Cognitive	Useful	22
	Not thinking	7		Profession	8
	Knowledge	7		Content	11
Affective	Interest	5	Affective	Cooperation	4
	Bias	4			

When Table 7 is analysed, it is seen that 2 categories and 5 codes emerged as their answers before the STEM education were examined. The pre-service teachers thought that STEM education would provide them to learn new information, and it would contribute to their teaching when they are in-service, that they wanted to do different things, not ordinary things anymore, that it would attract the attention of the students and increase their creativity. In addition, some pre-service teachers stated that they did not think that the STEM education would not contribute to them, that they had no information related to STEM, not interested, had information but they did not apply it, they did not believe they could do and they are biased; that is, that they did not believe they would learn new things or believe that robot could be built by cycling the waste materials. When their answers after the STEM education are examined, it is seen that it consists of 2 categories and 4 codes. It was determined that all of the pre-service teachers believed that they learned new things thanks to STEM education. They claimed that they found it useful, that is, their knowledge base expanded, they did different and beautiful things with waste materials, they regarded the materials differently, they thought about what they could do with the waste materials around them, and thus they began to attribute a different meaning to each item around them, and they learned a lot that they had never heard of, but did not know what the reason was. Besides, they stated they

learned the working logic of simple machines, how to set up circuits and motorised installations, and how to make motorised toys and that they learned the working principle of the machines around them. They expressed that the content of the course was entertaining, interesting, economical and efficient, had simple content and was equipped with full knowledge, practical knowledge, new knowledge and easily applicable knowledge. Moreover, they added that it had a different, creative and technological content, they learned different methods and techniques, they gained new information by doing research and they learned to produce something original. On account of their profession, they referred that they had a very different experience, they saw many things that they had not seen in their education life, that they learned how to think through trial and error, that they saw that they could do different things, that making materials was fun and that they learned different methods and techniques. In terms of cooperation, the pre-service teachers stated that it contributed to the students' cooperation in producing a different product, developing a sense of cooperation, and developing a positive sense of dependency.

Thoughts before taking the training;

"…I did not know how this training would affect me or gain skills."

"…I have no idea about his contribution as I did not receive the training before."

Thoughts that occur after receiving the training;

"…After receiving the training, I found that I gained new knowledge and skills in a range of mathematics, science, and technology."

"…Although the information about the subjects is also given in other education models, the most important aspect that distinguishes it from other education models is that it provides skills. It enabled the knowledge to be more permanent and embodied with applications."

" …I had the opportunity to understand the diversity and benefits of 21st-century skills that come with STEM. I gained knowledge and skills about robotics and design."

"…The aims of STEM education coincide with the acquisitions and skills that the preschool child should acquire. STEM education will provide me with the skills to teach these to children in the right way."

"With this training, there have been improvements in my mental skills, including my manual dexterity. Because the activities we did and learned made a positive contribution to our every development.

When Table 8 is analysed, it is noticed that the answers of the students to the question Do you think the STEM education with simple materials contribute to your gaining information and skill? Why? How? consists of 3 categories and 7 codes. Some of the pre-service teachers referred that they had various biases such as they were not curious about STEM Education, they were not interested or it was expensive and difficult to implement, they thought that it was difficult to build a robot, that they had negative thoughts, that they did not know that activities would be done with simple materials, that they had various prejudices such as a sense of incompleteness, being distant and unfamiliar with the subject, thinking that they could not build a machine.

It is seen that the pre-service teachers' answers after the STEM education consist of 3 categories and 13 codes. The pre-service teachers expressed that the STEM education is useful in gaining new information and skills, that simple materials can be easily reconciled with STEM Education, that it taught how to build simple engine systems and the working system of the engines of machines, useful in making great projects from simple machines, that it gained the ability to build a new machine, that it turned the existing deficiency into a plus, that they learned how to build a circuit and with it, that they learned very good things, that it was beneficial to look at things from a different perspective and to think creatively, and to be able to do creative and technological activities at the same time, that it was effective and profitable teaching that attracted the attention of children and contributed to the development of their sense of curiosity and developed their hand skills. Besides, they claimed that they provided scientific thinking by improving the thinking skills of STEM education and increased the number of studies by developing their imagination. In addition, thanks to the STEM education, they stated that they could prepare fun activities with simple materials and the materials at hand, that they could produce beautiful products, that they could produce effective products in cheap ways, and that they were happy to produce a product.

After the STEM education, the pre-service teachers stated that that they started to reuse waste materials and that they could do STEM activities with waste materials.

Thoughts before taking the training;

"…What impact or skill will this education provide to me?"

"… Since I have not received the training before, I have no idea about its background."

"…I lost my prejudices because I did not know how the effectiveness was reduced with simple components before the training. "I had negative conditions such as not being able to do it."

Thoughts that occur after receiving the training;

"…After receiving the training, I saw that I gained new knowledge and skills regarding a number of mathematics, science and technology."

"… It enabled the knowledge about the subjects to be more permanent and to be concretized with applications."

"...I had the opportunity to understand the diversity of knowledge and skills that come with STEM, its benefits."

"...With this training, there were improvements in my mental skills, including my manual dexterity. We created beautiful products with cheap materials. The events were very fun."

Table 8. Do you think the STEM education with simple materials contributes to your gaining new skills? Why? How? What are your thoughts before and after the STEM education?

Before the education			After the education		
Category	**Code**	**Frequency**	**Category**	**Code**	**Frequency**
Cognitive	Useful	9	Cognitive	Useful	19
	Not useful	5		Thinking skill	3
				Preparing activity	2
				Information	1
				Product	7
Affective	Bias	9	Affective	Interest	3
	Interest	1		Entertainment	2
Content	Simple motor	2	Content	Waste material	4
	Waster material	2		Machine	3
	Knowledge	1		Motor	2
				Moving object	1
				Car	1
				Robot	1

When Table 9 is analysed, it is seen that the answers of the pre-service teachers before the STEM education to the question Do you want to apply the STEM education with simple materials in your lessons? consists of 2 categories and 4 codes. The pre-service teachers stated that they did not want to apply STEM education in their lessons because they did not have information about STEM education. Besides, they claimed they had various biases such as the STEM education was difficult, they would not apply it in their courses, that they could not afford the costs when they make a robot, that they thought of it as a costly lesson, that they felt inadequate in this regard, they thought that they would not even make simple materials with STEM, they hesitated to apply it because it was difficult to implement it. In addition, they added that they were uninterested in STEM Education because they did not want to do activities in the same style all the time and because they were not someone who wondered how engines and things work.

When their answers after the STEM education were analysed, it is seen that 3 categories and 7 codes emerged. All of the pre-service teachers stated that they wanted to use STEM education in their lessons in professional life. In addition, they claimed that they wanted to apply the STEM education in their courses because they find the STEM education useful, that it gave children a different perspective, that they did activities using simple materials, that it was both interesting and fun to teach, that they could attract attention with STEM instead of classical paper activities, that it would give students problem-solving skills, that it would teach them to think scientifically, that it should be included in the lessons to make students more determined. Besides, they added that it would enable them to express themselves creatively and in different ways, direct them to do creative activities, that it is also beneficial as it does not cause financial problems, that STEM will not force financially because there are too much waste materials in preschool, that it will be beneficial in terms of providing students with new knowledge and skills, that they plan to establish simple systems with both toys and children.

The pre-service teachers claimed that using STEM in courses would be entertaining, the children would be interested in the products, all kinds of things could be made with waste materials; with batteries, motors, keys, that children would understand better with the help of simple materials and that simple materials would not put them into trouble in terms of the expenses. Thoughts before taking the training;

"…I had no idea before I got the training."

"…Because I did not know the content of the training, I was undecided about whether I would like to apply it."

Thoughts that occur after receiving the training;

"…Children can learn more by doing and experiencing, and they will have the opportunity to both have fun and learn with applications."

"…Yes. By dividing the children into groups, each group is expected to make a robot in the presence of the teacher. In this way, children witness both motors, circuits or technological devices, as well as their simple construction stages. In addition, cooperation, which is one of the aims of STEM education, is provided in the classroom environment."

"…I would like to implement it. Because I believe that this education gives students many life skills and initiative, and creates more creative ideas by taking pleasure." When Table 10 is analysed, it is seen that the answers of the pre-service teachers to the question 'Do you want to get STEM education with simple materials?' after the STEM education consist of 2 categories and 6 codes. The pe-service teachers stated that they could not find the logic because they did not know about STEM Education, that the course was useless and they did not want to take it because they thought that this approach was implemented with complex mechanisms.

Table 9. Do you want to apply STEM education with simple materials in your courses? Why? How? What are your thoughts before and after the education?

Before the STEM education			After the STEM education		
Category	**Code name**	**Frequency**	**Category**	**Code name**	**Frequency**
Cognitive	No information	2	Cognitive	Useful	44
				Different viewpoint	
	Interest	5		Interest	2
Affective	Insufficient	3	Affective	Entertaining	
	Bias	16			
				Material	3
			Content	Simple circuit elements	4
				Simple material	3

Table 10. Do you want to get advanced STEM education with simple materials? Why? What are your thoughts before and after the STEM education?

Before the STEM education			After the STEM education		
Category	**Code**	**Frequency**	**Category**	**Code**	**Frequency**
Cognitive	I would like to	6	Cognitive	useful	13
	I wouldn't like to	7			
	No information	7			
Affective	Indifference	5	Affective	Interested	2
	Bias	4		Bias	3
	Deficiency	3		Willing	13
			Content	Content	2

In addition, they also stated that they did not want to get an education as they thought they could not apply the STEM education, that they did not regard themselves sufficient in the field of STEM Education, that they thought that it was a numerical-weighted course and that they had biases that it would be sufficient to learn a few activities. Besides, some of the pre-service teachers claimed that they found the STEM course unnecessary, that the course did not appeal to them and that they did not want to take the course because they felt inadequate.

When the pre-service teachers' answers after the STEM education were analysed, 3 categories and 5 codes emerged. All of the pre-service teachers stated that they wanted to get an advanced STEM education. They referred that it was useful for children, that it could be adapted to pre-school, it contributed to the profession, it gave children a new perspective by reasoning, helped in daily life, that they could go beyond classical education and increase their personal experience and knowledge thanks to the STEM education. Besides, they claimed that it was enjoyable and developer, it was a lesson that every teacher should take, they could learn more effectively with students, they contributed in the technological field, they improved themselves, and their desire to do different activities with STEM Education increased. Moreover, they expressed that STEM Education did not consist of complex mechanisms and incomprehensible systems, that it could also be realised with the materials in our lives, that they could produce very different products with simple materials, that they enjoyed their work more, and that the concept of learning by doing was exactly that. Thoughts before taking the training;

"…I was undecided because I didn't know exactly about STEM education before."

"…I thought it would be okay if I didn't take it because I thought it wouldn't help me."

"…I had no idea before I received the training, I wouldn't want to."

Thoughts that occur after receiving the training;

"…I would like to take advanced level because STEM is a broad field. It helps the educator diversify the concepts to be given to the child."

"…Children's interest in science, science, math, etc. increases interest in the field. These trainings provide children with the opportunity to do and live and increase their self-confidence. I want to buy it both to contribute to personal development and to benefit my students in the future."

Discussion and Conclusion

At the end of the study, it was found that STEM education had a positive effect on the pre-school pre-service teachers' lifelong learning tendencies, that is, enriched it. In addition, it was determined that STEM Education had a positive effect on the perseverance, lack of arranging learning, lack of curiosity sub-dimensions, which are the sub-dimensions of lifelong learning tendencies, but it had no effect on the dimension of motivation.

Some studies in the literature support this result. In the study by Çalik (2020), it was determined that STEM activities and STEM-based robotic activities developed the lifelong learning skills of the pre-service science teachers. In addition, it was found in the study that the STEM and STEM-based robotic activities developed the lifelong learning skills' sub-dimensions: motivation, perseverance, lack of arranging learning and lack of curiosity skills. Ellis and Fouts (2001) state that the STEM approach positively affects many different developmental areas of children and provides the opportunity for students to look at issues from multiple perspectives and see real-life applications in the classroom environment. Thi Per et.al. (2021) mentioned in their study the benefits of STEM education, which should start when students are very young. According to the qualitative data of the study, the pre-service teachers stated, before they got the STEM education, that they did not want to apply it since they did not have any information about STEM education and could not comprehend its logic and thought that it was useless, and it was performed with the complex mechanism.

In addition, they stated that they did not want to take STEM education as they thought they could not apply it, that they regarded themselves as inadequate in the STEM education field, that they had biases such as it was math-related course and learning some activities would be sufficient. Besides, some of the pre-service teachers stated that they did not want to get STEM education as they thought that the course was useless, did not appeal to them, did not attract their attention, and felt inadequate. It was determined that all of the pre-school pre-service teachers thought that STEM education contributed to their personal development, gaining new information and skill and they wanted to get STEM education and apply it in their lessons after they had taken the STEM education. Moreover, it was determined that it developed their creativity; they started to produce new, different and creative materials from waste materials, improved their perspectives, and they gained the ability to look at materials and technology from a different perspective. Besides, they claimed that they found STEM education useful, contributed to personal development, developed a sense of competence, increased confidence in doing things, that they thought that they would be beneficial to students with fun activity researches, and they started to search for fun activities including simple motors for students. in the results of the doctorate study named as the reflections of STEM teachers education on the teachers of early childhood, that it influenced the viewpoints of the participating teachers towards STEM education (Meral and Altun Yalçın, 2019), supported the content, 21st century, pedagogy, context and integration knowledge and skills, raised their awareness of the importance of STEM education in early childhood (Azamet and Altun Yalçın, 2020) and affected the STEM teacher perceptions. Uyanık Balat and Günşen (2017), referred in their study related to the significance of STEM education in the pre-school period that our children will take the theoretical knowledge revealed by basic sciences such as physics, chemistry, biology, and mathematics and will contribute to innovations that will add value to life by integrating with technology and engineering, and that education programs and activities should be prepared based on this approach. They claimed that the STEM education developed their creativity and contributed to their solution producing skills; thus, they could produce different and creative materials, that they could produce useful productions by using daily life materials, developed viewpoints by looking at the materials and lessons from different points and their negative thoughts changed. In addition, they referred that they made the working system of the machines understandable and that they benefited the robot making and robotic coding by creating different products. Besides, they referred that STEM education did not consist of complex mechanisms and incomprehensible systems, that the materials in our life could be used, that they could produce very different products with simple materials, that they enjoyed their work more, and that was exactly what the concept of learning by doing. Epçaçan (2013) defines lifelong learning as the individual's ability to control his/her learning process, taking responsibility, being open to changes and innovations and adapting, and being willing to receive information by communicating effectively with his/her environment (Çalik, 2020). Lifelong learning to the individual, contributes to both professional development and individual development (Çakır and Yalçın, 2022). What is aimed at lifelong learning is individuals' planning their learning, using the information they learned by learning to learn in different situations, applying learning strategies in different situations and using active learning skills (Arcagök and Şahin 2014). Besides, Schuman, Besterfield-Sacre and Mcgourty (2005) referred the lifelong learning as the ability to use information and communication technologies, to think critically, to question and to the awareness in learning. According to Selvi (2011), lifelong learning has five basic features as meeting the needs of society and individuals, creating new information acquisition opportunities and learning environments throughout their lives, revealing sources of motivation for individuals' learning, identifying ways related to individuals' self-realization, organising and structure useful knowledge structure, and improving individuals' learning skills. When the definitions and features of lifelong learning were taken into consideration, it can be claimed that STEM Education

exactly overlaps with lifelong learning. It can be stated that STEM education has the role of supporting the development of the pre-school pre-service teachers' lifelong learning skills. It was determined that the pre-service teachers thought that STEM education was useful in acquiring new knowledge and skill, that the simple materials could easily be reconciled with STEM Education, would teach to set up simple engine assemblies and the working system of the engines of the machines, that it was useful in making great projects from simple machines, gained the skill to make a new machine, turned the existing deficiency into an advantage, that the students learned how to build a circuit and with it a lot of nice things, that it enabled them to look at events from a different perspective and to think creatively, as well as enabling to do creative and technological activities, that it was an effective and profitable education that attracted the attention of children and contributed to the development of their sense of curiosity. In addition, it was determined that they thought that STEM education developed thinking skills, improved scientific thinking and imagination, even an increase in the number of relevant researches were observed. It was also found that they thought that they could prepare entertaining activities with simple and existing materials, prepare good products, effective products with cheaper ways, that these creations made them happy and began to recycle waste materials, that they could do STEM activities with waste materials. Kara (2018) claimed as a result of the study named as the design-based Learning in pre-service teachers' STEM workshops that the transformation of the pre-service teachers into practice in STEM workshops rather than theoretical knowledge has a positive effect on Learning, and it contributes to gaining a different perspective, creativity skills, increasing communication power, and learning useful and different information as STEM benefits.

Lifelong learning is a supportive process that increases and strengthen the knowledge, values, skills and understanding that people have gained throughout their lives, and enable them to apply them in real life (Rausch 2003). A lifelong learner is an individual who plans and measures his/her learning, brings together information from different disciplines when necessary, and uses different learning strategies (Knapper and Cropley 2000). Besides, lifelong learning is not to acquire the information as it is and memorise it, but to obtain the information by researching and questioning in accordance with the requirements of the age, to use the acquired information by interpreting it (İzci and Koç 2012). Lifelong learning combines home, school, workplace and community learning and encourages effective education opportunities (Takemata et al., 2008). Besides, it supports the processes of individuals to gain experience by using discovery, creativity and imagination (Fischer 2013). When these characteristics of lifelong learning are taken into consideration, it is seen that it demonstrates similarity with the gains of the pre-service teacher thanks to STEM education. For instance, it can be claimed that the features such as knowledge and skills that they gained during the STEM education, cognitive skills they acquired and different viewpoints, researching, imagining, scientific thinking, ensuring interdisciplinary knowledge transfer support their lifelong learning skills and hence develop it.

All of the pre-service teachers claimed that they wanted to get advanced STEM education. Because, it was determined that they thought that it was useful for children, it could be adapted to pre-school, it gave children a new perspective by reasoning, they would understand better, they could attract attention with STEM instead of classical paper activities, it would give students problem-solving skills, teach them to think scientifically, should be included in the lessons to make students more determined. In terms of their profession, they stated that they had a very different experience and experience, they saw many things that they had not seen in their education life, they learned how to think through trial and error, they saw that they could do different things, it was very fun to make materials, and they learned different methods and techniques. In terms of the cooperation, they referred that it contributed to the students' cooperation in producing a different product, developing a sense of cooperation, and developing a positive sense of dependency. In addition, they claimed it contributed to their profession, that it was a course that all of the teachers should get, that they would realise more effective courses with students, that they wanted to make activities with STEM education more, it was determined that it helped them in daily life, that they could go out of classical education thanks to STEM Education. Furthermore, it was determined that they thought it would enable them to express themselves creatively and by finding different ways, direct them to do creative activities, that STEM would not force financially because waste materials were too much in preschool. They claimed that they saw the materials with a different perspective, that they thought about what they could do with the waste materials around them, and thus they began to attribute a different meaning to each item around them, and that they learned a lot of things that they had never heard of, but did not know what the reason was. In addition, they expressed that they learned the working logic of simple machines, building circuits and motorised installations, making motorised toys, and the working principle of the machines around them. According to Dominik and Fischer (2000), lifelong learning is the continuous desire and need of individuals to learn on their own. An individual should have the motivation to learn, be determined to learn, have learned to learn, self-assessment, planning and organising learning features (Aspin and Chapman, 2000). According to Polat and Odabaşı (2008), people who can learn life long, are the individuals who have the skills to reach the necessary information in the solution of any problem, use this information and add innovation. In addition, they are expected to be able to use learning strategies in different environments, can find information using resources that

can help to learn, and have the skills to use and interpret materials from various subject areas (Knapper and Cropley, 2000). Lifelong learning is a feature that increases the knowledge and skills acquired by individuals throughout their lives and enables them to apply them in life (Rausch, 2003). Besides, it is a process that develops the individual's potential and competencies throughout life (Demirel, 2008), supports them to be more professionally equipped and productive in their business life (Akbaş and Özdemir, 2002), that strengthens ties with professional and social life (Reinsch 2007; Yıldırım, 2015), in which the ability to solve problems that s/he encountered is gained and individuals, who can adapt to change and progress, are raised (Yılmaz, 2016), personal development is supported, that provides the completion of deficiencies, turns the wrong knowns into the right, or the development of undiscovered skills (Göksan, et al, 2009). The compatibility of these basic features of lifelong learning with the features of STEM Education can be seen as supporting each other. Thus, STEM education can be included in the curriculum of education faculties to improve the lifelong learning skills of pre-school pre-service teachers and contribute to their development in terms of knowledge, skills, experience and professional competence. The STEM education of pre-service teachers in their pre-service period will not only improve their lifelong learning skills but also enable them to be experienced in STEM Education. In this way, teachers, who have learned lifelong learning, will both be role models for the development of these aspects of students and offer their students a rich, more innovative and more contemporary learning environment in this scope. In addition, they will be more willing and self-confident in integrating STEM education, which is new, production-oriented, based on interdisciplinary learning, and provides the development of the individual's mental and hand skills, into their courses.

Genişletilmiş Özet

Giriş

STEM Eğitimi yeni bir eğitim anlayışı olup, fen, matematik, mühendislik ve teknoloji alanlarının bütünleştirilerek öğretilmesini amaçlayan farklı bir eğitim sistematiğine sahiptir (Sanders, 2009). Öğrenci sadece tek bir alanla ilgili bilgi ve deneyim edinmeyip, edindiği bilgiyi diğer alanlarla ilişkilendirme, transfer etme, kullanma ve anlamlandırma süreci ile karşı karşıya kalmaktadır (Bee 2010; Çakır, Yalçın ve Yalçın 2019; Çiftçi ve Topçu 2021). Bu durum öğrencilerin kendi öğrenmelerinden sorumlu olduğu, kalıcı ve anlamlı öğrenme yaşantıları gerçekleştirmelerini sağlamaktadır (Çevik, Danıştay ve Yağcı, 2017). Birey kendi öğrenmesini kendi öğrenme hızı ve kendi öğrenme stili ile gerçekleştirir ve zihinsel kodlamasını yapar. Öğretmen burada öğrenci ile öğrenen ve öğrenciye rehberlik eden, onlara yol gösteren konumundadır (Aydoğan Yenmez vd. 2021). STEM Eğitimi öğrencilerin sahip olduğu beceri ve yetenekleri destekleyerek onların 21. yüzyıl becerileri olarak nitelendirilen özelliklerinin de geliştirdiği belirlenmiştir (Çetin ve Kahyaoğlu, 2018). 21. yüzyıl becerilerinin tamamı yaşam boyu öğrenme ile bağlantılıdır (Gvaramadze, 2007) ve bununla birlikte 21. yüzyıl becerileri yaşam boyu öğrenme için gerekli beceri ve yeterlilikleri içermektedir (Van Laar et al., 2017). Hatta öğretmenlerin yaşam boyu öğrenme eğilimleri ile 21. yüzyıl öğreten becerileri arasında anlamlı bir ilişki bulunmaktadır. Buna göre öğretmenlerin yaşam boyu öğrenme eğilimlerinde yükselme olması hâlinde 21. yüzyıl öğreten becerilerinde de yükselme olacaktır (Kozikoğlu ve Altunova, 2018). Öğretmen mesleğe başladığında kendini geliştirmek ve yenilemek noktasında özverili hareket etmelidir. Bunu sağlamanın yolu öğretmenin hizmet öncesinde ve hizmet içinde sürekli öğrenme ve hayat boyu öğrenme konularında faydalı eğitim almalarından geçmektedir (Kazu ve Erten, 2016; Altun Yalçın, 2019).

Yöntem

Çalışmada karma yöntem türlerinden biri olan açıklayıcı deseni kullanılmıştır. Karma yöntem araştırmaları, araştırmacının bir çalışma veya birbirini izleyen çalışmalar içerisinde nitel ve nicel yöntem, yaklaşım ve kavramları birleştirmesini içerir (Fraenkel, Wallen ve Hyun, 2012).

Araştırmada ulaşılabilir evren ve amaçlı örnekleme yöntemi tercih edilmiştir. Amaçlı örnekleme yöntemi, araştırılacak konu, olay ya da olguya ilişkin önemli bilgi kaynaklarına ulaşmada araştırmacıya yardımcı olur ve araştırılması istenen durumların derinlemesine incelenmesine fırsat sunar (Teddlie ve Yu 2007). Araştırmanın örneklemini, Doğu Anadolu Bölgesi'ndeki bir devlet üniversitesinde 2019-2020 eğitim öğretim yılı, eğitim fakültesi okul öncesi öğretmenliği bölümünde öğrenim gören 22 öğretmen adayı oluşturmaktadır.

Veri toplama aracı olarak yaşam boyu öğrenme eğilimi ölçeği ve yarı yapılandırılmış görüşme formu kullanılmıştır. 27 maddeden oluşan ölçek, Diker Coşkun (2009) tarafından geliştirilmiştir. Ölçek derecelendirme şeklinde olup 6'lı likertten oluşmaktadır.

Sonuç

Basit malzemelerle yapılan STEM eğitimlerinin okul öncesi öğretmen adaylarının yaşam boyu öğrenmelerine ilişkin etkiyi belirlemek amacıyla ön ve son test puanları arasında yapılan paired samples t-test sonuçlarında uygulama öncesi puan ortalaması (öntest = 92,27) ile uygulama sonrası yapılan puan ortalaması (sontest =99,27) arasında anlamlı bir fark görülmüştür (t21: -2,565; p< 0.05).

Ölçeğin birinci alt boyutu olan Motivasyon boyutuna ilişkin wilcoxon işaretli sıralar testi sonuçlarında ön-test ve son-test puanları arasında anlamlı bir fark görülmemiştir (Z = -1,330; p=,184 > .05).

İkinci alt boyut olan sebat etme boyutunda; uygulama öncesi puan ortalaması (öntest = 23) ile uygulama sonrası yapılan puan ortalaması (sontest =26,50) arasında anlamlı bir fark görülmüştür (t17: -3,556; p=0,002< 0,05).

Üçüncü alt boyut olan öğrenmeyi düzenlemede yoksunluk boyutunda; uygulama öncesi puan ortalaması (öntest = 9,85) ile uygulama sonrası yapılan puan ortalaması (sontest =14,20) arasında anlamlı bir fark görülmüştür (t17: -3,304; p=0,004< 0,05).

Dördüncü alt boyut olan merak yoksunluğu boyutunda; uygulama öncesi puan ortalaması (öntest = 30,44) ile uygulama sonrası yapılan puan ortalaması (son test =35,27) arasında anlamlı bir fark görülmüştür (t17: -2,660; p=0,017< 0,05).

Çalışmanın nitel verileri doğrultusunda öğretmen adayları STEM almadan önce; STEM Eğitimi hakkında bilgilerinin olmadıkları için mantığını bulamadıklarını, dersin gereksiz geldiğini, karmaşık düzeneklerle bu işin yapıldığını düşündükleri için almak istemediklerini söylemişlerdir. Ayrıca STEM Eğitimi yapamayacağını düşündükleri için almak istemediklerini, kendilerini STEM Eğitimi alanında yeterli görmediklerini, sayısal ağırlıklı ders olduğunu düşündükleri ve birkaç etkinlik öğrenmenin yeterli olacağı şeklinde ön yargılarının olduğunu belirtmişlerdir. Bununla birlikte öğretmen adaylarının bazıları STEM dersini gereksiz bulduğunu, dersin kendilerine hitap etmediğini, dikkatlerini çekmediğini ve kendini yetersiz hissettiği için STEM Eğitimini almak istemediklerini ifade etmişlerdir. STEM Eğitimi aldıktan sonra ise; okul öncesi öğretmen adaylarının hepsinin STEM Eğitiminin kişisel gelişimlerine, yeni bilgi ve beceri kazanmalarına katkısının olduğunu düşündükleri ve ileri düzeyde STEM Eğitimi almak istedikleri ve derslerinde uygulamak istedikleri tespit edilmiştir. Bununla birlikte yaratıcılıklarının geliştiğini, atık malzemelerden yeni, farklı ve yaratıcı materyal üretmeye başladıklarını, bakış açılarının geliştiğini, materyallere ve teknolojiyi farklı perspektiften bakma becerisi kazandıklarını düşündükleri tespit edilmiştir.

Tartışma

Çalışmanın sonuçları STEM eğitimininin bireyin yaşam boyu öğrenme eğilimlerini olumlu etkilediğini göstermiştir. Bu bulgu önceki araştırmaları desteklemektedir. Çalik (2020) tarafından yapılan çalışma da STEM etkinlikleri ve STEM temelli robotik etkinliklerinin fen bilimleri öğretmen adaylarındaki yaşam boyu öğrenme becerilerini geliştirdiği tespit edilmiştir. Yaşam boyu öğrenme; kişilerin hayatları boyunca kazandıkları bilgi, değer, beceri ve anlayışları artıran ve güçlendiren, bunları gerçek yaşamda uygulayabilmeyi sağlayan destekleyici bir süreçtir (Rausch 2003). Yaşam boyu öğrenen birey kendi öğrenmesini planlayan, ölçen, gerektiğinde farklı disiplinlerdeki bilgileri bir araya getiren ve farklı öğrenme stratejileri kullanan bireydir (Knapper ve Cropley 2000). Ayrıca; bilgiyi aynen alma ve ezberleme değil de çağın gereklerine uygun olarak bilgiyi araştırarak ve sorgulayarak elde etme, edindiği bilgiyi yorumlayarak kullanmadır (İzci ve Koç 2012). Yaşam boyu öğrenme ev, okul, iş yeri ve toplum öğrenimi birleştirir ve etkili eğitim fırsatları teşvik ettirir (Takemata vd., 2011). Bununla birlikte bireylerin keşfetme, yaratıcılık ve hayal gücü kullanarak deneyim elde etmeleri süreçlerini desteklemektedir (Fischer 2000).Yaşam boyu öğrenmenin bu özelliklerine bakıldığında; öğretmen adaylarının STEM Eğitimi sayesinde elde etmiş oldukları kazanımlarla paralellik gösterdiği görülmektedir. Örneğin STEM Eğitimi esnasında elde etmiş oldukları bilgi ve beceriler, kazanmış oldukları zihinsel beceriler ve farklı bakış açısı, araştırma yapma, hayal etme, bilimsel düşünme, disiplinler arası bilgi geçişini sağlama gibi özelliklerinin onların yaşam boyu öğrenme becerilerini desteklediği ve böylece geliştirdiği söylenebilir.

Etik Kurul İzin Bilgileri

Araştırmanın etik kurul izni, Erzincan Binali Yıldırım Üniversitesi İnsan Araştırmaları Etik Kurulu tarafından 01.09.2020 tarih ve 07/06 protokol numaralı kararı ile alınmıştır.

Araştırmanın Etik Taahhüt Metni

Yapılan bu çalışmada bilimsel, etik ve alıntı kurallarına uyulduğu; toplanan veriler üzerinde herhangi bir tahrifatın yapılmadığı, karşılaşılacak tüm etik ihlallerde "Cumhuriyet Uluslararası Eğitim Dergisi ve Editörünün" hiçbir sorumluluğunun olmadığı, tüm sorumluluğun Sorumlu Yazara ait olduğu ve bu çalışmanın herhangi başka bir akademik yayın ortamına değerlendirme için gönderilmemiş olduğu sorumlu yazar tarafından taahhüt edilmiştir.

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