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Investigating the effects of STEM enriched implementations on school readiness and concept acquisition of children*

Mehmet Toran, *Istanbul Kültür University,* Turkey, *m.toran@iku.edu.tr* ORCID: 0000-0003-3457-9113
Ebru Aydın, *Marmara University,* Turkey, *e.aydin.ayvaz@gmail.com* ORCID: 0000-0001-6982-5957
Damla Etgüer, *Istek Bilge Kağan Schools,* Turkey, *dml.etgr@gmail.com* ORCID: 0000-0002-3350-725X

Abstract. The aim of the study is to investigate the effect of STEM enriched preschool education implementations on children's school readiness and concept acquisition. The study was conducted with experimental design with pretest-posttest control group. The sample group of the study consisted of thirty-three children from the age group of 60-68 months. While 16 of the children were included in experimental group, 17 were included in control group. Before the implementations, the activities which were based on STEM skills and for which expert opinions were taken were developed. All activities were completed in nine weeks. Bracken Basic Concept Scale-Revised Form was used as the data collection tool in the pretest-posttest. As a result of the study, it was found that there was a statistically significant difference between the total scores of both school readiness and concept acquisition in favor of the experimental group. Based on the results, it can be asserted that early STEM activities supported preschool education program in school readiness and concept acquisition.

Keywords: STEM education, STEM in preschool education, school readiness, concept acquisition

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INTRODUCTION

Sense of modern education has led researchers to identify appropriate methods and techniques for qualified education and they have conducted many studies for this purpose. Undoubtedly, one of the notable movements among them is the STEM approach which has spread from the United States of America (USA) to many countries. The acronym STEM stands for the first letters of Science, Technology, Engineering, and Mathematics. Along with the expansion and development of STEM education in recent years, many explanations have been made on the place of this acronym in education and this approach has been included in numerous programs. In general, STEM education refers to learning and teaching knowledge and skills in fields of science, technology, engineering and mathematics from preschool education to doctorate (Gonzalez and Kuenzi, 2012). However, STEM is not limited only with these. STEM's objectives in education are to enable the individual to gain knowledge, attitude and skills to make evidence-based inferences by determining the problems in life. Besides, they also aim at understanding the characteristics of STEM disciplines within the framework of knowledge, questioning and design and raising awareness about how STEM disciplines affect the material, spiritual, intellectual and cultural environment. In addition, it was stated that subjects related to STEM were constructive, relevant, and reflective and made individuals willing to deal with the ideas of science, technology, engineering and mathematics (Bybee, 2013).

There are three different approaches in the literature drawing attention to the implementation of STEM education. The first one is the Silo Approach. In Silo Approach, each STEM discipline is addressed in an isolated way or in an integration with a very low level and it is therefore coded as S-T-E-M by some researchers (Dugger, 2010). This approach is based on the acquisition of knowledge rather than the acquisition of practical-based technical skills (Morrison, 2006). Another approach is the Embedded Approach which is based on problem solving techniques on the basis of producing social, cultural and functional solutions over daily life problems (Chen, 2001). This approach aims students to strengthen and complete what they have learned in other courses in the current course. Here, there is an exchange between STEM

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disciplines. The information area belonging to one discipline may also belong to another discipline. However, Embedded Approach involves a problem that a student cannot relate the embedded content to the content of the course. In such a case, rather than benefiting the whole course, the student faces with the risk of learning only the parts of the course (Roberts and Cantu, 2012). The third approach in STEM education is the Integrated Approach. The purpose here is to create a single learning field by addressing at least two STEM disciplines in an integrated way. Further studies and project-based education are provided by combining the fields of science, technology, engineering and mathematics including the works of a scientist or an engineer in real life (Brainer, Harkness, Johnson and Koehler, 2012). In addition, it can be asserted that the approach mostly accepted and applied by many researchers is the Integrated Approach.

It is seen in the literature that the studies taking STEM education as basis are carried out mostly in the second grade of primary school or at secondary school level. When the STEM education studies conducted in preschool period are compared with the other levels, it can be said to remain in the background especially in Turkey (Akgündüz et al., 2015; Ministry of National Education, 2016). First of all, the reasons for this are the question of whether or not engaging in fields such as engineering and technology by children at their early ages is developmentally appropriate. It is seen that in educational programs developed in various countries, especially in the USA, especially skills requiring spatial thinking such as engineering have become a part of early childhood education (Brainer, Harkness, Johnson and Koehler, 2012; Corlu, Capraro and Capraro, 2014). The basis of this education approach is shown as the determining role of thinking skills acquired in early childhood period on future experiences (Brophy, Klein, Portsmore and Rogers, 2008; Evangelou, 2010). Another problem is the idea that along with the implementations appropriate for the development of young children, the disciplines requiring expertise in this way require a deep expertise over the skills teachers currently have. However, the main objective in STEM education conducted in early period is to provide children with an interdisciplinary education opportunity for their development by supporting their scientific process skills rather than giving them the opportunity to acquire high level of science, arithmetic or engineering skills (Bagiati, Yoon Yoon, Evangelou and Ngambeki, 2010). In fact, preschool educators are those who would contribute to the development of children's thinking skills by presenting concepts and practices of STEM disciplines in accordance with their developmental capacities and needs. In addition, when the Preschool Education Program published by the Ministry of National Education in 2013 is examined, it is seen to emphasize integrated education approaches that give priority to real life experiences rather than teaching a specific subject independently in all kinds of science education as much as in science and technology.

The most effective way for young children to be interested in STEM disciplines and to associate the knowledge they gained in these areas with real life is undoubtedly to ensure learning through play. Children develop skills such as collaboration, communication and creativity in these games and learn basic knowledge of the disciplines such as science, mathematics, technology and engineering within a social interaction (Van Hoorn, Monighan, Scales and Rodriguez, 2011). In activities conducted with young children, teachers should involve children basic concepts and skills of STEM education and also guide them to explore and discover. They should adopt an approach that will support children's curiosity, reflect their cognitive processes and allow them to ask more questions by exploring more in each activity process.

When the literature is examined, it is seen that there are some studies that reveal the effectiveness of STEM education on school readiness and concept acquisition of children. In the study conducted by Aldemir and Kermani (2017), it was aimed to investigate the effect of integrated STEM curriculum on the mathematics and science skills of children attending Head Start schools. In a study conducted within the framework of the experimental pattern involving 62 children aged between three-six years, STEM activities were carried out with 36 children in the experimental group for 10 weeks. As a result of the study, it was seen that the mathematics and science-nature skills of the children in the experimental group developed a positive and significant difference compared to the children in the control group. In an experimental study conducted by Öcal (2018), she investigated the effect of early STEM education program on scientific process skills of children and it was found as a result of the study that there was a difference in scientific process skills of children in favor of the experimental group. In addition, it was seen in the retention test implementations that the effect arising in scientific process skills of children was permanent. In the study by Solis, Curtis, and Hayes-Messinger (2017), children's status of using STEM concepts in play processes in which children interact with objects was examined. In the study, 20 children were observed in free play times for two days a week for eight weeks. As a result of the study, the children were seen to use physical concepts such as friction, tension, force, energy, and stress. Besides, it was determined that children found solutions to the problems they encountered in play processes by transforming the objects in their class into simple machines and attempted solutions through spatial thinking.

Preschool period is a very convenient period for children to acquire STEM skills and to gain awareness about these disciplines. Children continuing preschool education can build a building, ramp or bridge with the materials in the block center (engineering and mathematics), calculate the amount of water that can pass under the bridge they designed (science and mathematics) and then investigate these structures at the computer center (technology) (Gonzalez, 2016). In all of these processes, children learn STEM concepts and associate them with real life. Therefore, it can be asserted that early STEM education has both direct and indirect effects on concept acquisitions of children. As a result of a study conducted by Malena et al., (2018), it was shown that early STEM activities caused a significant increase in children's use of concepts related to engineering and technology. The rich stimulating environment concept acquisition presented to the children at early ages helps the child to easily perceive the relationship between events, situations and objects and to easily make sense of this perception by arranging it (Bracken, 1998; Toran, 2011).

When the basic assumptions of STEM education are investigated, it is seen that they cover getting ready to use a skill, competence and transferring it to life (Wilkerson and Haden, 2014). It is stated that using the acquired competence and transferring it to life is related with readiness. Readiness refers to improvement of academic and developmental competence, ability to do something of a child to a certain level and be ready to the next developmental and academic competence step and varies from child to child (Taylor, Clayton and Rowley, 2004). Developmental and academic competences in life are built on the previous competences and make the child ready for the next period. When it is evaluated in this context, school readiness is accepted as the developmental readiness of a child to the environment that child will face in formal education system and he/she perceives as a complex system (Hair, Halle, Terry-Humen, Lavelle and Calkins, 2006). The studies conducted with theoretical perspectives regarding the competence of the child in school readiness have indicated that school readiness has significant effects on academic competence of the child (Magnuson, Meyers, Ruhm, and Waldfogel, 2004; McWayne, Hahs-Vaughn, Cheung and Wright, 2012). In addition, it was shown that the support provided to the child about school readiness at an early age had a positive effect on the child's future life and also supported the child's ability to cope with difficulties in life (Magnuson, Meyers, Ruhm, and Waldfogel, 2004). In this context, it was determined that the rich implementations presented to children at early ages supported their school readiness (Brown, Benedett and Armistead, 2010; Toran and Temel, 2014). In addition, it has been emphasized that early STEM education is an effective approach in helping children to acquire knowledge and skills about school readiness such as analyzing, solving and assuming in preschool period (Katz, 2010). It was stated that the skills requiring spatial thinking such as using materials of different shapes, building various structures with blocks, and reaching to the whole by combining different parts form an important basis in school readiness (Verdine, Golinkoff, Hirsh-Pasek and Newcombe, 2014).

It is known that STEM education helps children to acquire many concepts and skills they need to acquire in preschool period. In this context, it can be said that STEM education forms a supportive approach to MoNE (2013) Preschool Education Program applied in Turkey in concept acquisition and school readiness. Nevertheless, it is seen that there is quite a limited number of early STEM implementation in preschool education and related scientific studies in Turkey. In a study conducted about early STEM implementations in preschool education in Turkey (Akgündüz and Akpınar, 2018), it was determined that children acquired gains for mathematics and science education and supported their creativity, cooperation, sharing and problem-solving skills. In addition, it was seen that the studies conducted in preschool education in Turkey were based on teacher candidates and document analysis. According to the studies conducted for awareness and attitudes of preschool teacher candidates towards STEM education, it was observed that there was an increase in the awareness and competence levels of teacher candidates receiving STEM education (Çakır, Yalçın and Yalçın, 2019; Koyunlu Ünlü and Dere, 2019). Besides, it was determined in the document analysis that only one review study emphasized the importance of STEM education in preschool level in Turkey (Ata Aktürk and Demircan, 2017). In addition, one study evaluated the gains and indicators in MoNE Preschool Education Programme in terms of STEM education (Ata Aktürk, Demircan, Şenyurt and Çetin, 2017). Starting from this limitation in the literature, the aim of this study was to investigate the effect of early STEM enriched preschool education implementations on school readiness and concept acquisition of children. More specially, this study attempted to answer the following questions:

1. Do STEM enriched implementations have an effect on school readiness and concept acquisition of 60-68-month-old children?
    a. Is there a significant difference between the school readiness scores of 60-68-month-old children in the experimental group received STEM enriched implementations and the control group received MoNE Preschool Education Program?
    b. Is there a significant difference between the concept acquisition total scores of 60-68-month-old children in the experimental group receivied STEM enriched implementations and the control group received MoNE Preschool Education Program?

METHOD

This study is a quasi-experimental trial with pre-test post-test control group investigating the effect of STEM enriched preschool education implementations on school readiness and concept acquisition of children. This design includes the implementation on ready groups in cases where it is not possible for the researchers to make random assignments (Büyüköztürk, Kılıç Çakmak, Akgün, Karadeniz and Demirel, 2016; Kirk, 2007). In this context, while the independent variable of the study was the STEM enriched preschool education application, the dependent variables were determined as school readiness competence and concept acquisition of children.

Participants

The participants of the study was composed of a total of 33 children including 17 girls and 16 boys aged between 60—68 months who were attending an independent kindergarten in Istanbul in the fall semester of the 2017-2018 academic year. Appropriate sampling method was used in the study. In this type of sampling, researchers obtain data on a voluntary basis from a sample they can reach easily (Kılıç, 2013). In this respect, independent preschool education institutions where the study would be conducted were contacted first and an institution which was willing about STEM education was determined. In these institutions, MoNE Preschool Education Program is applied and no special program is applied, as well. Two classes including the same age group of children were selected from the institution using random method as experimental and control groups. Parents' consents were obtained from the parents of all children included in the sample group and individual interviews were conducted with the children to see if they would like to participate in the activities before starting the program. After this interview, it was determined that all children wanted to participate in the activities and the participation status to the activity was evaluated by conducting preliminary meetings with children before each implementation. In both volunteering studies, it was found that the children wanted to participate in the activities and there was no child loss in the group. Table 1 shows demographic characteristics of the experimental and control groups.

Table 1. *Demographic information about the sample group*

Group	Age	Girl	Boy	Total
Experimental	5	7	9	16
Control	5	10	7	17
Total	5	17	16	33

When Table 1 was examined, it was observed that 16 of 33 children in the sample group were included in the experimental group and 17 were in the control group. While 7 of the children in the experimental group were girls and 9 were boys, 10 of the children in the control group were girls and 7 were boys.

Data Collection Tool

In the study, Bracken Basic Concept Scale-Revised Form was used to determine concept acquisition of children as data collection tool. The scale was developed by Bruce A. Bracken (1998) to measure school readiness and concept acquisition of children. Its validity and reliability studies were conducted in Turkey by Uğurtay Üstünel (2007) for 3-5-year-old children and by Aral and Bütün Ayhan (2007) for 6-year-old children. Bracken Basic Concept Scale-Revised Form is composed of 11 sub-tests and 308 items. The sub-tests in the scale are color, letter, number/counting, sizes, comparison, shape, direction/position, individual/social awareness, texture/material, quantity and time/sequence. Total scores obtained from the first six sub-tests of the scale are evaluated as the school readiness score and total score taken from all tests indicates the concept development level of the child (Bracken, 1998; Uğurtay Üstünel, 2007).

In the Turkish adaptation of Bracken Basic Concept Scale-Revised Form, one-way analysis of variance (ANOVA) was performed to compare test scores in terms of age groups. In cases where there was a statistically significant difference, Scheffe Test was used to determine the differences between which groups. Results of Scheffe Test conducted between group mean scores showed that the test scores significantly increased as the age increased and Bracken Basic Concept Scale-Revised Form was found to have high validity for 3, 4, and 5 year-old children. In the same study, the reliability of a total of 83 conception scores was examined by using Kuder Richardson formula and the total concept scores were determined as .98 for KR-20 reliability total, .98 for 3 year-old children, .99 for 4 year-old children and .98 for 5 year-old children. These results showed that the reliability of the scale was very high (Uğurtay Üstünel, 2007).

Research Process

For the skills taking early STEM skills as basis, the gains aimed to be reached primarily were determined by the researchers. Some of the achievements based on early STEM skills were taken from MoNE Preschool Education Program and some were prepared by the researcher. For the gains prepared by the researcher, opinions from three field experts were obtained and they were finalized and matched with appropriate activities. Besides, nine activities based on early STEM skills were prepared by the researchers before the implementation. The activities were prepared within the frame of the integrated approach based on science, technology, engineering and mathematical skills of children. The prepared activities were presented to the opinion of two different preschool education experts and the activities were finalized by making necessary revisions in accordance with the obtained expert opinions.

Two of the researchers participated in the activities applied in the classroom as the assistant teacher in the first two weeks, two days a week for 5 weeks to carry out the adaptation process with children before data collection and implementation and then conducted the adaptation process of the children by applying routine activities independent from the teacher. Bracken Basic Concept Scale – Revised Form was applied by the researchers for pretest to a total of 33 children in both the experimental and control groups. During the implementation of the test, a quiet, bright and stimulus-free environment was preferred in the school. The researchers first introduced themselves to the child to whom the test was going to be conducted and tried to create a reliable environment by asking the child to introduce himself/herself. It took an average of 30-40 minutes to apply tests for each child. After the completion of the pretests, early STEM activities were applied by one of the researchers to a class determined as the experimental group one day per week for nine weeks and the other researcher only observed the process as a passive participant and kept anecdotal records. On the other days when the implementation were not conducted, the children continued to receive the MoNE Preschool Education Program. No special program was applied to the control group and MoNE Preschool Education Program continued to be applied by the classroom teacher. As a result of a total of nine activities applied to the experimental group, Bracken Basic Concept Scale –Revised Form was applied as posttest to both experimental and control groups.

Data Analysis

When data obtained in the study were examined, inequalities were observed causing from pretest scores of the experimental and control groups. However, since the conditions such as that the groups are independent from each other, the distribution is normal, the groups have equal variance, within-group regression coefficients are equal, covariate and dependent variable are in a linear relationship are met (Buyukozturk, 2018), Two-Way ANCOVA was used. Since two-way covariance analysis was used, pretest scores were accepted as covariate.

RESULTS

Table 2 shows the distribution about the pretest and posttest arithmetic mean scores of children in the experimental and control groups from Bracken Basic Concept Scale–Revised Form.

Table 2. *Distribution of pretest and posttest arithmetic mean scores of the experimental and control groups*

	Experimental (n=16)					Control (n=17)			
	Pretest			**Posttest**		**Pretest**		**Posttest**	
	x	Adjusted *x*	sd	*x*	sd	*x*	sd	*x*	sd
School readiness	53.06	57.79	11.46	69.94	10.17	62.74	10.09	68.71	10.97
BBCS	189.38	207.79	40,39	253.75	28.15	225.12	30.05	251.06	28.24

When Table 2 was examined, it was seen that the arithmetic mean of school readiness total scores of the children in the experimental group was 53.06 in the pretest and 69.94 in the posttest. The arithmetic mean of the school readiness total scores of the control group was seen to be 62.24 in the pretest and 68.71 in the posttest. When the total scores taken from the scale were examined, it was seen that the pretest arithmetic mean score of the experimental group was 189.38 and the posttest arithmetic mean score was 253.75. When the total scores of the control group from the scale were examined, it was observed that the pretest arithmetic mean score was 225.12 and the posttest score was 251.06.

Table 3 shows the results of two-way covariance analysis for the adjusted school readiness scores of the children in the experimental and control groups based on pretest scores.

Table 3. *The results of two-way covariance analysis for adjusted school readiness scores of the children in the experimental and control groups by pretest scores*

Source of Variance	KT	sd	KO	F	p	η^2
School readiness	2005.527	1	2005.527	40.903	.000	.577
Group	451.153	1	451.153	9.201	.005	.235
Error	1470.940	30	49.031			
Total	161985.000	33				

R Squared = .578 (Adjusted R Squared = .550)

According to Table 3, it was found that there was a significant difference between the school readiness mean scores adjusted according to Bracken Basic Concept Scale – Revised Form of children in the experimental and control groups ($F=9.20$, $p<.05$). School readiness scores of children in the experimental group were seen to cause as significant difference compared to children in the control group. School readiness mean scores of the children caused a significant difference in favor of the experimental group. It can be asserted that about 58% of this difference was due to STEM enriched preschool education implementations given to the experimental group ($\eta^2= .577$).

Table 4 shows the results of two-way covariance analysis about the adjusted concept acquisition scores by pretest scores of children in the experimental and control groups.

Table 4. *The results of two-way covariance analysis for the adjusted concept acquisition scores based on pretest scores of children in the experimental and control groups*

Source of Variance	KT	sd	KO	F	p	η^2
Concept acquisition	16032.497	1	16032.497	55.788	.000	.650
Group	4261.125	1	4261.125	14.827	.001	.331
Error	8621.444	30	287.381			
Total	2126398.000	33				

R Squared = .651 (Adjusted R Squared = .628)

According to Table 4, it is seen that there was a significant difference between children in the experimental and control groups in terms of the adjusted concept acquisition mean scores of Bracken Basic Concept Scale –Revised Form ($F=14.82$, $p<.05$). The concept acquisition mean scores of the children was found to cause a significant difference in favor of the experimental group. It can be asserted that 65% of this difference was associated with STEM enriched preschool education implementations given to the experimental group ($\eta^2=.650$).

DISCUSSION and CONCLUSION

When the results of this study conducted to investigate the effect of early STEM enriched preschool education implementations on school readiness and concept acquisition of children were evaluated, it was found that early STEM implementations were in favor of children in the experimental group. When the results obtained from the study were evaluated in detail, it was observed that the early STEM enriched preschool education implementations were effective on school readiness of children and this effect was in favor of the experimental group according to the statistical analysis. Besides, it was determined that the readiness initial (pretest) score difference which was in favor of the control group was transformed into the favor of experimental group with STEM enriched preschool education implementations. In the study by Öcal (2018), it was observed that early STEM education program was effective on scientific process skills accepted as a part of school readiness and it was also found in retention study that STEM education program had effectiveness. Besides, in the study by Akgündüz and Akpınar (2018), they determined that STEM implementations made during preschool period improved creativity, critical thinking, cooperation and communication skills covering academic skills and school readiness. Similarly, academic competencies of children were found to improve as a result of preschool program implementations enriched with mathematics, science and technology (Kermani and Aldemir, 2015). In parallel with this result, in their study, Nayfeld Fuccillo and Greenfield (2013) examined the relationship between the executive functions and school readiness in early age learnings and found that especially science-based implementations supported this relationship positively. In the study conducted to help children to learn basic concepts related to STEM through games, it was found that the children carried out the STEM activities effectively through games and this had a positive effect on children's academic skills (Torres-Crespo, Kraatz and Pallansch, 2014). Besides, it was determined in the study by Aldemir and Kermani (2017) that the integrated STEM program was effective on the academic skills of children attending Head Start Schools. When the previous studies were evaluated, it was determined that early STEM studies and early STEM enriched implementations had positive effects on school readiness competencies of children. In addition, it was also found that enriched preschool education programs supported children's competencies such as attention, creativity, problem solving, predicting, cooperation, collaboration, and sharing along with school readiness (Diazgranados, Borisova and Sarker, 2016; Shah et al., 2017).

With this study, it was determined that the effect of early STEM enriched preschool education implementations on concept acquisition of children was in favor of the experimental group. When the results obtained from the study were evaluated in detail, it was observed that early STEM enriched preschool education implementations were effective on children's concept acquisition and this effect was in favor of the experimental group according to the statistical analysis. Besides, it was also observed that there was an increase in the school concept acquisition scores in the control group who received MoNE Preschool Education Program. However, this increase was not at the level of the experimental group who received implementations enriched with early STEM activities. From this point of view, it can be asserted that the preschool education implementations enriched with early STEM activities had a positive effect on school concept acquisition. In the study conducted by Solis, Curtis, and Hayes-Messinger (2017), the children's status of using STEM concepts in game processes where they interacted with objects was examined and the children were observed to use physical concepts as a result of the study. Besides, it was also observed that children developed various solutions to the problematic situations they face during playing processes. It was determined that these solutions were associated with concept acquisition of children, they defined the problems with conceptual competencies and generated solutions. On the other hand, in their study Gonzalez (2016) determined that early STEM education applied to preschool children at risk had no effect on the concept acquisition of children but the researchers stated that this result may be due to various characteristics of the sample group or the duration of the training given. Besides, in another study supporting the results of the current study, it was determined that early STEM implementation facilitated children's acquisition of basic concepts (Aldemir and Kermani, 2017). However, it can be asserted with the results of the studies (Diazgranados, Borisova and Sarker, 2016; Kermani and Aldemir, 2015 Leibham, Alexander and Johnson, 2013; Torres-Crespo, Kraatz and Pallansch, 2014; Wilkerson, and Haden, 2014) enriched child centered preschool implementations and STEM enriched implementations are effective on science concept acquisition of children and they are in parallel with the results of the current study.

It is seen that the early STEM education made with an approach considering individuals differences and appropriate for the development level of children (Elkind, 2015; Farley, Brock and Winterbottom, 2018) has a supportive role in concept acquisition and school readiness. It is crucial for preschool children to adopt and apply scientific approaches, especially when dealing with problematic situations. Thus, children will be able to look at everything in real life from a scientific point of view and thus make logical explanations and inferences in situations that are unknown or unfamiliar to them.

The requirements of the century stipulate now that children should receive a qualified STEM education. The curiosity and enthusiasm of children at early ages show that knowledge and skills of STEM disciplines can be easily obtained in this period. Especially when teachers constantly guide children to think, explore, test and experiment, use materials for different purposes and solve problems, children acquire the skills of scientific thinking and scientific point of view and understand the physical and mathematical dimension of the world.

The most important limitation in the design of the present study can be accepted as the fact that the implementations were enriched with early STEM without interfering the program that was currently followed by the children. However, the fact that the results of this enrichment study is in favor of the experimental group makes the study strong in the context of providing significant contributions to the field.

RECOMMENDATIONS

In order for STEM education to be applied qualitatively in a preschool period, teachers should have basic knowledge about different disciplines and develop their skills that can integrate these disciplines. In this context, the primary step to be taken is to organize training and seminars for teachers to gain knowledge and skills about STEM education and its content. Besides, it is recommended that teachers sometimes should ask for a support from experts working in STEM disciplines in in-class activities and make use of their experiences.

It is recommended that the current education environment should be made suitable for STEM education in terms of both environment and material aspects. In particular, it is recommended to provide education institution with necessary hardware that can serve technology dimension of STEM disciplines.

In this study, the effect of early STEM - enriched preschool education implementations provided with preschool education program to the children in preschool period on their concept acquisition and school readiness levels was investigated. As stated earlier, STEM education supports the development of children in many areas along with these skills. In the future studies, how STEM education supports children's different skills can be examined.

Besides, there has been no assessment instrument measuring STEM skills of children in Turkey, yet. In this context, it is recommended to develop measurement tools that will measure the effectiveness of STEM education.

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