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THE EFFECT OF STRUCTURED MATERIAL SUPPORTED COLLABORATIVE CODING WORKSHOPS IN PRESCHOOL EDUCATION ON STUDENTS' BASIC SKILLS

Research article

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Abstract

The aim of this study; The aim of this study is to determine the effect of applying the cooperative learning method together with structured materials in coding workshops on the basic skill levels of preschool students and to evaluate them together with the opinions of teachers and parents. A quasi-experimental design with pretest-posttest control group was used in the research conducted in accordance with the mixed research design. The study group of the research consists of 35 students, 15 girls and 20 boys, studying in two branches in a kindergarten located in Sivas city center in the first semester of the 2021-2022 academic year. Cooperative learning method was used in one of the branches in the study and the existing learning method was applied in the other. "Basic Skills Scale for Preschool Students" was used to obtain quantitative data. In the analysis of data; descriptive statistics, ANOVA, Tukey, dependent groups t test and content analysis were used. In the quantitative findings of the research; It was determined that there was no significant difference between the pretest scores of the research groups from the scale, and that there was a significant difference between the pretest-posttest scores of the experimental group in favor of the posttest. It was observed that there was no significant difference between the pretest-posttest scores of the control group and the posttest scores of the research groups. In the qualitative findings of the research; It has been determined that the application has a positive effect on different development areas of the students, the use of structured materials contributes to learning and its use in different acquisitions is supported.

Keywords: Coding education, cooperative learning, basic skills, preschool

1. Introduction

Human beings have continued to learn, develop and change since the day they existed. Every age and every process has brought its own teaching, knowledge and experience. In today's world, technology is one of the most influential factors in this ongoing journey of human beings. The slowly changing human life in the past has now reached an acceleration that we can call almost overnight at an incredible speed with technology. In order to adapt to this dizzying speed, it is inevitable for people to think faster, be open to development and change, and become individuals who not only use technology but also produce new information content by using technology. In this direction, computers started to be used in education for the first time both in the world and in Turkey in the early 1980s (Akpınar & Altun, 2014). The use of computers in education has become widespread in the process and has started to be used in almost every level and course. In the next period, besides the use of computers in the lesson, changes were observed in terms of producing their own information

content related to any subject or course. In this direction, courses have started to be included in the education programs. Although these courses were called programming at first, they were named as coding in the process (Serim, 2019).

In technological vehicles with electronic brains, all the following commands that enable the hardware to work and give direction on how it should work are called coding (Gülbahar, Kalelioğlu & Karataş, 2017). In addition, the software skill used in computer programming is called coding (Duncan, Bell, & Tanimoto, 2014). Coding, which is a computer software language, has unlimited processing possibilities and each coding language has its own rules (Ersoy, Madran, & Gülbahar, 2011). Of course, in order to understand the coding language, it is necessary to know these rules first. In this sense, it is important to have coding language literacy (Zamin, Rahim, Savita, Bhattacharyya, Zaffar, & Jamil, 2018). However, the main purpose of students learning the coding language is not to make them professional software developers, but to develop their different thinking skills, awareness, perceptions and problem-solving skills (Jenkins, 2002; Seğmen, 2017; Wing, 2006). With the coding education given to the students, it is aimed to develop high-level skills such as creative thinking, analytical thinking, systematic thinking, scientific thinking, computational thinking and problem solving, which are accepted as 21st century skills (Fessakis, Gouli, & Mavroudi, 2013). Coding education has started to be seen as one of the basic education fields, especially in developed countries in the world, and has started to take its place in curricula as a compulsory or elective course (Department for Education, 2013). In Turkey, coding education started to be given for the first time in the 5th and 6th grades in 2013 as part of information technologies and software courses (Sarıkoz & Alpan, 2019). The necessity of giving coding education at an early age has been discussed and steps have been taken in some countries. In many countries such as Korea, China, India, Canada, Spain, and India, necessary steps have been taken for students to receive coding education at an early age (Monroy-Hernández, & Resnick, 2008; Shin, Park, & Bae, 2014).

At an early age, students have difficulty in understanding the concept of coding because their abstract thinking skills have not yet developed. Therefore, in the process, they experience loss of motivation, not achieving the expected gains, inadequacy in learning and, due to all these, failure in the course (Jenkins, 2002). In order to prevent this, it is necessary to use the educational materials related to coding by making concretization. Especially in coding education given at an early age, using objective materials is the most effective way for students to be successful, as it embodies knowledge (Shim, Kwon, & Lee, 2017). A higher level of success is achieved in coding education where objective materials that students can touch and feel are used. These studies, in which objective materials are used, are also called robotic coding or physical coding. Students are more interested in such materials, learn by having fun, and have less problems with long-term attention, which is a problem especially at young ages, instead of lessons or exercises on the computer (Kasalak, 2017).

Coding education given in the pre-school period provides important contributions to all development areas and especially supports the development of cognitive skills of students (Fessakis, Gouli, & Mavroudi, 2013). Cognitive skills of students in scientific thinking, nature and science are called basic skills. These skills are needed to produce valid solutions to problem situations in daily life (Celep & Bacanak, 2013; Kazeni, 2005). These skills are very important for preschool students to develop a basic scientific perception, understanding and understanding (Aktamış & Ergin, 2007). Myers, Washburn, and Dyer (2004) emphasize that basic skills form the basis of science and enable individuals to develop their research and inquiry skills. The development of students' basic skills increases their level of taking responsibility for their own learning by enabling them to be more active and confident in their learning processes. In addition, it supports students' learning about science and supports

their understanding of research methods and methods for any subject (Çepni, Ayas, Jonhson, &Turgut, 1996). Basic skills; It consists of the skills of classifying, observing, communicating, measuring, using numbers, making inferences, making predictions, and using space and time relations (Chabalengula, Mumba, & Mbewe, 2012; Germann, Aram, & Burke, 1996; Turiman, Omar, Daud , & Osman, 2011). With the acquisition of basic skills in preschool students, the foundation of higher level cognitive skills is laid (Padilla, 1990; Rambuda & Fraser, 2004). Basic skills and higher-level skills acquired in the next process are considered as step-by-step successive steps and are seen as a combination of scientific thinking together (Germann & Aram, 1996). Therefore, it is stated that if students acquire basic process skills, also called initial skills, it will be easier for them to acquire high-level skills that they need to acquire from the second level of primary education (Büyüktaşkapu, 2010; Ergin, Şahin-Pekmez, & Öngel-Erdal, 2005). In this context, gaining basic skills in early childhood is seen as the basis of scientific education (Büyüktaşkapu, 2010).

It is seen that there are two different approaches regarding how to gain scientific thinking skills. In the first of these, it is argued that some scientific facts should be memorized by children, while in the second, the necessity of using process skills (Wallace & Louden, 2002). Those who defend the first thought consider students who remember and transfer the memorized information correctly as successful (Solomon & Aikenhead, 1994). Children's concepts of science, just like numbers, shapes, colors, etc. They also center the traditional learning model because they believe that they should learn like concepts (Bereiter, 1994). Supporters of the second view, on the other hand, accept that scientific concepts go far beyond memorization or just learning. Science education; they think that a process and perception of the physical environment paves the way for research (Merton & Storer, 1979). They argue that every science student should be seen as a scientist from early childhood (Staver, 1998). In this direction, they say that science education should be given through curricula prepared in accordance with the constructivist theory. In constructivist theory, as in scientific thinking, students play an active role in structuring knowledge, recreating and developing the acquired knowledge. (McCormick & Paechter, 1999; Tzuo, 2007). The student reconstructs and makes sense by combining newly learned information with the information that already exists in his mind. Since the individual is active in the learning process, he or she learns by reinterpreting the information in his mind according to his own foreknowledge and personal characteristics, no matter which source he acquires (Özmen, 2004). The main point in constructivism is to acquire the knowledge, skills and behavioral characteristics necessary for the process of acquiring knowledge (Brook & Brooks, 1993; Marlowe & Page, 1998). Merrill (1991) states that in constructivist education, the student reshapes the knowledge he has acquired by passing it through his own cognitive processing processes, and transforms it into a more understandable form in his own mental reality.

There are many different learning models and methods such as Multiple Intelligences, Project-Based Learning, Problem-Based Learning, Project-Based Learning, and Cooperative Learning, developed in accordance with the constructivist approach (Bayrakçeken, Doymuş, & Doğan, 2013). Cooperative learning is a learning model in which students work together in heterogeneous groups of 2-6 people, are responsible for each other's learning, helping each other, sharing and in-group communication are prominent, and each student is actively and actively involved in the learning process (Doymuş, Şimşek, & Bayrakçeken, 2004; Slavin, 1999). In the literature review, it has been seen that the cooperative learning model is widely used at all levels of education, however, the number of studies for the preschool period is limited (Büyüktaşkapu, Çeliköz, & Akman, 2012; Hallumoğlu, 2019; Öztürk & Tanrıverdi, 2019).

1.1. Purpose of the Research

The positive effect of cooperative learning on learning has been demonstrated by many studies (Arslan, 2019; Cahya, & Sholihah, 2017; Erlidawati, & Syarfuni, 2018; Hayatina, & Fajrina, 2018; Juliana, & Surya, 2017; Çalık & Altay, 2021). Before this study was conducted, no study was found on the effect of the application of the structured material supported cooperative learning method in pre-school education on the basic skill levels of children in coding workshops. The researchers decided to carry out the study, accepting that this study would contribute to the related literature and be a source for other researchers and experts who prepare preschool education programs. The aim of this study; The aim of this study is to determine the effect of applying the cooperative learning method together with structured materials in coding workshops on the basic skill levels of pre-school students and to evaluate them together with teachers' opinions. In the research, it was planned to obtain information in both quantitative and qualitative dimensions. Basic skill scale (BSS) was applied to preschool students in the quantitative dimension of the research, and a semi-structured interview form was applied to teachers and parents in the qualitative dimension, and the answers to the following questions were sought.

1.1.1. Quantitative Questions

1) Is there a significant difference between the application of the structured material supported cooperative learning method in pre-school education in coding workshops between the pre-test scores of the children who received pre-school education in the research groups?

2) Is there a significant difference between the pre-test and post-test scores of the pre-school education children in the research groups in the application of the structured material-supported cooperative learning method in coding workshops in pre-school education?

3) Is there a significant difference between the application of the structured material-supported cooperative learning method in pre-school education in coding workshops, between the post-test scores of the children who received pre-school education in the research groups?

1.1.2. Qualitative Questions

1) What are the views of teachers and parents on the implementation process of coding workshops, the use of structured materials, and what other achievements can be used in preschool education of the structured material-supported cooperative learning method in pre-school education?

2. Method

In this part of the research, information about the study group, data collection tools, and data analysis are presented.

2.1. Research Design

In this study; A quasi-experimental design with control group was applied. Research groups were determined by using criterion sampling, which is among the purposive sampling methods. Criterion sampling is a selective sampling method that is not based on probability (Patton, 2014). Random assignment is made in assigning research groups as experimental and control groups (McMillan & Schumacher, 2010). While quantitative methods enable an existing phenomenon, event and situation regarding any research topic to be revealed as it exists, qualitative methods enable to determine the reasons by going deeper rather than describing the phenomenon, event and situation (Karagöz, 2019). The use of quantitative and qualitative methods together is called mixed method (Baki & Gökçek, 2012). According to

the purpose of the research, the researcher chooses the appropriate one from different mixed method designs. It was decided that it would be appropriate to use convergent parallel mixed research design in this study. In this research design, quantitative data and qualitative data are obtained regarding the same process. Different analysis processes are performed according to the structure of these data. Findings obtained through both methods are presented together, and aspects that support or do not support each other are revealed. In this way, more comprehensive and detailed findings are presented at the end of the research (Creswell & Plano-Clark, 2011). In order to obtain the data in the quantitative dimension of the research, the Basic Skills Scale was applied as a pretest before the application and as a posttest after the application. A semi-structured interview form consisting of three questions was used to obtain the qualitative data of the study.

2.2. Study Group

In the research, the schools and branches where the application will be made were determined by interviewing the school administrations and pre-school teachers. In order to carry out the application, application permission was obtained by applying to the Sivas Provincial Directorate of National Education with a petition. It was decided to conduct the research in two branches of a kindergarten located in Sivas city center with 60-72 months old children. In this context, the study group of the research consists of 35 students, 15 girls and 20 boys, who receive pre-school education in two branches of a kindergarten located in Sivas city center in the fall semester of the 2021-2022 academic year. Branches were randomly assigned as the experimental and control groups. There were 20 students in the experimental group (EG) in which the structured material supported cooperative learning method was applied, and 15 students in the control group (CG). In order to comply with the principle of impartiality in practice, the following criteria were complied with:

- ✓ The students in the research groups are between 60-72 months.
- ✓ Students in the research groups receive pre-school education for the first time.
- ✓ The students in the research groups do not have any health problems that may affect the results of the research.

The distribution of the students in the research groups by gender is given in Table 1 below.

Table 1. *Distribution of research group students by gender*

Groups	Female		Male		Total
	n	%	n	%	n
EG	9	45.00	11	55.00	20
CG	6	40.00	9	60.00	15

When the distribution of the research groups by gender is examined in Table 1, it is seen that the number of male students is higher, but this difference is not at the extreme points. The students in the experimental group, together with the classroom teacher, were divided into six heterogeneous groups consisting of four three people and two four people, taking into account their gender and learning success. Afterwards, the students were asked to name their groups by talking to them. Table 2 below contains information about this.

Table 2. *Experimental group group names and distribution of students to groups*

Group Name	Female (n)	Male (n)	Toplam (n)
Pıtırcıklar Group	2	2	4
Papatya Group	1	2	3
Panda Group	2	2	4
Çilek Group	2	1	3
Yunus Balığı Group	1	2	3
Tavşancıklar Group	1	2	3

2.3. Data Collection Tools

The data of the research were obtained by using the "Basic Skills Scale for Preschoolers" and a semi-structured interview form.

2.3.1. Basic Skills Scale for Preschool Students

The scale developed by Aydoğdu and Karakuş (2015) in obtaining the data; It consists of five sub-factors, namely Classification (4 items), Measurement (4 items), Observation (4 items), Inference (4 items) and Prediction (4 items) and a total of 20 items. There are explanatory pictures suitable for pre-school students in each of the questions in the scale prepared as multiple choice with three options as A, B and C. The questions are prepared in a simple way that preschool students can understand. The reliability of the scale was determined as 0.74 in the scale development study, and 0.71 in this study. The correct answers given by the students to the scale items were evaluated as “1” and the wrong answers as “0”. According to this, students get 20 points if they answer all the questions correctly, and 0 points if they answer incorrectly.

2.3.2. Interview Form

İnterview method; It is a flexible method that allows in-depth information to be obtained in research on any subject (Büyüköztürk, Kılıç-Çakmak, Akgün, Karadeniz, & Demirel, 2014). Through the interview method, the researcher finds the opportunity to determine the attitudes, interests, comments, thoughts, perceptions and reactions of the participants regarding a phenomenon or situation (Yıldırım & Şimşek, 2005). Interviews are divided into two main categories as structured and unstructured interviews. In this study, semi-structured interview method was used. The literature regarding the research was scanned and the questions that could be asked within the scope of this study were examined. Afterwards, parallel forms consisting of three questions were prepared to be applied to teachers and parents in accordance with the aims of the research. These forms were reviewed and the opinions of two pre-school teachers were received in terms of language, relevance to the subject, clarity, etc. The final form of the interview form was given, taking into account the feedback received. Within the scope of the research, the following questions were asked from the practice teacher and the parents of the students.

- ✓ Can you evaluate the positive/negative aspects of the impact of coding education on the developmental areas of children? / Could you explain your positive/negative views on the impact of the coding education application process at school on your child's developmental areas, together with the reasons?

- ✓ Could you explain your views on the effect of using structured materials in coding education on children's learning? / Could you explain your views on the effect of using structured materials in coding education on your child's learning?
- ✓ What other achievements do you think structured materials can be used in pre-school education? Can you explain why?

2.4. Validity and Reliability Study for Qualitative Data

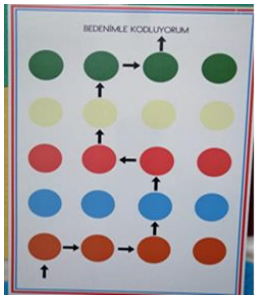
In order to ensure validity and reliability in qualitative research, the concept of internal validity used in quantitative research is replaced by the concepts of persuasiveness, external validity is replaced by transferability, internal reliability is replaced by consistency, and external validity is replaced by confirmability (Yıldırım & Şimşek, 2005). The criteria of "long-term interaction", "deep-focused data collection", "expert review" and "participant confirmation" were complied with to ensure credibility in the research. The researcher acted in accordance with the criteria of long-term interaction by conducting interviews with the participants in line with the purpose of the research and in a sufficient time. Before the interview, necessary explanations were given to the participants and they were provided to answer the questions on a voluntary basis and without any guidance. In order to meet the deep-focused data collection criterion, an attempt was made to maintain a critical point of view, and attention was paid to ensure that the participants gave adequate, relevant and truthful answers to the questions in the interview form. In order to meet the expert review criterion, two experts in qualitative research were examined for the research, the questions of the research, the data obtained in the research and the analysis process of these data. The research process was carried out within the framework of the feedback received from the experts. In order to avoid ambiguity in the data obtained in order to meet the criterion of participant confirmation and to avoid wrong evaluation by the researchers, the data obtained after the interviews were repeated to the participants. The data obtained in order to meet the transferability criterion was transferred to the reader by sticking to the data obtained without any intervention in accordance with the emerging concepts and themes. Detailed explanation of each stage of the research is presented. In order to ensure the consistency of the study, consistency analysis was carried out. It is necessary to look at the research from an objective point of view and to determine whether the researcher acts in harmony in the activities he/she carries out throughout the whole process. For this, the interviews were recorded to reveal that the researcher asked the participants in the interviews in a similar way and asked the same guiding questions. The data obtained in the research were coded separately by both researchers and then brought together to determine common points. After a two-week period, the data were reviewed separately and brought together again to reach a consensus. In order to ensure the confirmability of the research, all the raw data obtained, the coding information about the analysis process, the notes, writings and inferences that were the source of the report were kept.

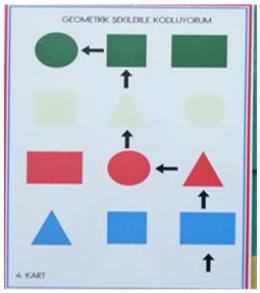
2.5. Materials Used

In the studies conducted in the literature, the materials used in pre-school coding education were examined in detail and it was seen that there was a very limited number of materials. Odacı and Uzun (2017) mentioned the inadequacy of pre-school coding materials in their study. Researchers examined these limited materials for coding education and developed four new and different materials from natural wood to improve coding skills. These materials were examined by the material development specialist, preschool education specialist and preschool teachers and their positive opinions were received. Afterwards, sample applications of each of these materials were made to students in four different kindergartens, and teachers were informed about whether there was a problem where the children had problems. After a

few minor adjustments, the final ready-to-use materials were decided. The materials prepared as much as the number of groups were ordered from easy to difficult. Each week, all groups were given one piece of the same material to enable them to work together in accordance with the cooperative learning method. A different material was applied each week. The explanations of the materials are given below in order of weekly application.

In the first week, the materials I code with my body and I code with geometric shapes, which were applied in the same way, were applied. One of these materials consists of circular shapes and the other consists of geometric shapes. The materials arranged at certain intervals on the ground have routing commands. The students move from the entrance to the exit by acting in accordance with the instructions in their hands. The arrows in the instructions are not fixed and are repositioned to determine a different path for each student.

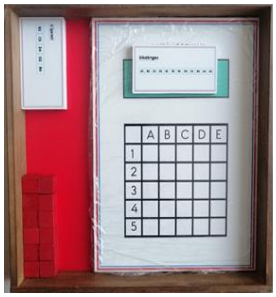


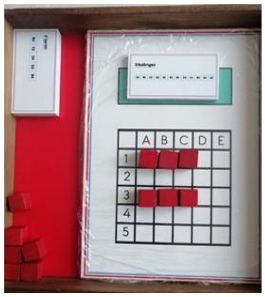



In the second week, the material coding with colors was used. Material-colored wooden cubes consist of a box with application area showing which color points which arrow direction. Each color points in a direction. Students take one of these cubes one by one and tell their friends which is the appropriate place in the application area. After getting the approval of his friends, he places the cube there. All arrows in the application area are covered with suitable cubes.

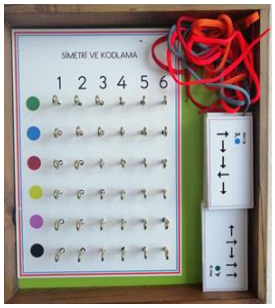



In the third week, the material named coordinate painting was used. The combination of letters and arrows on the material consists of wooden cards with instructions, small wooden cubes and an application box. When the cubes are placed in accordance with the commands on each card, the shape written on the card is created. Students place the cubes in the application area, respectively, according to the command on the card. Each time, the student first determines the place where his cube will be placed, and then puts the cube after getting approval from his friends.






In the fourth week, the material called symmetry and coding was used. The material consists of wooden cards, colored threads and an application box, which are instructions on the combination of colors and arrows. The student starts to pass the rope through the hooks in the application area according to the first color and number on the card, by taking the rope suitable for the color written on the card. Then, following the card, he passes the rope to the hooks in the direction of the arrow. Each student, in turn, repeats the same process with different cards by getting approval from their friends.





2.6. Application Process

The experimental and control group teachers who voluntarily agreed to participate in the study were interviewed. The experimental group teacher was informed about the purpose of the research, the application to be made, cooperative learning, the materials to be used, the points to be considered, and the measurement procedures. Each question that the teacher asked to the researchers was answered in detail. The control group teacher was also informed about the measurement procedures to be applied at the beginning and end of the process. Demographic information of the students was obtained from the teachers of the experimental and control groups. The students in the experimental group were interviewed and they were informed in a very simple language about the application to be made. An exemplary application was made in order to attract the attention of the students, to see if there was a possible problem, and to avoid any problems in the actual application. In addition, all the necessary support was given to the teacher in the whole process. It was determined that there was no problem in the feedback received from the teachers and students for the application. Before the application, the basic skill scale was applied to the research groups as a pretest. The scales were applied individually to the students in the research groups and due care was taken not to be affected by the answers of each other. Considering the possibility of students not coming to school due to the Covid 19 process, the application made with the same material was repeated for two hours on two different days (Monday-Thursday) and carried out for four weeks. The application was carried out for a total of 16 hours and after it was finished, the basic skill scale was applied to the research groups as a post-test. Again, the scale was applied individually to the students in both the experimental and control groups. After these processes, semi-structured interview forms prepared to get the opinions of the practice teacher and parents on the practice were used on a voluntary basis. Each response of the practice teacher and 12 parents who agreed to the interview to the questions on the forms was recorded without any intervention.

2.7. Data Analysis

The quantitative data obtained in the research were entered into the digital environment and analyzed with the SPSS package program. Shapiro-Wilk (S-W) test was applied to determine whether the data of the research groups met the normality values regarding BSS. The findings obtained in the analyzes showed that the data met the normality values.

Accordingly, it was decided to use parametric tests. In this context, dependent groups t test, independent groups t test, one-way ANOVA, Tukey test were applied. Frequency and content analysis were used in the qualitative data of the study. The opinions of the practice teacher and parents were evaluated together. Both researchers created themes and sub-themes by coding the data separately. Afterwards, the obtained themes and sub-themes were brought together and their compatible and incompatible aspects were determined. At the first stage, it was seen that the findings of the researchers were in agreement with 70%. The data, which were studied separately, were again brought together and evaluated. This time, the agreement of the researchers' findings was found to be approximately 90%. For a more objective evaluation of the findings, a two-week break was taken and then the findings were combined and the final version was presented. An assessment-evaluation expert who is competent in qualitative research was asked to evaluate the coding. The findings, which were finalized in accordance with the expert recommendations, were tabulated in order to facilitate their understanding. The opinions of teachers and parents are presented under the title of the same table. In accordance with the confidentiality principle, the identities of the participants were not given and coding was used instead of the name. For example, “T-F-35-10” expresses the expansion of practice teacher, woman, age, working year, while “P-M-32-1” expresses parent, mother, age and participant. Below each table, there are sample statements from the answers received from the participants regarding the question asked to ensure transferability.

3. Findings

The findings obtained in this part of the study will be presented in tables. First of all, quantitative data and then qualitative data are included.

3.1. Quantitative Results

The results of the independent groups t-test applied to determine whether there is a significant difference between the pretest scores of the research groups from the BSS scale are given in Table 3.

Table 3. *Independent groups t-test results regarding the pretest scores of the research groups from BSS*

	Groups	n	X	ss	sd	Levene test		t	*p*
						F	*p*		
Classification	EG	20	2.75	1.02	33	0.245	.624	0.767	.508
	CG	15	2.47	1.13					
Measuring	EG	20	2.95	0.76	33	3.484	.071	1.774	.449
	CG	15	2.33	1.18					
Observation	EG	20	3.35	1.14	33	0.487	.490	-.528	.090
	CG	15	3.53	0.92					
İnference	EG	20	2.60	1.05	33	4.563	.040	-1.254	.601
	CG	15	3.00	0.76					
Prediction	EG	20	2.90	1.07	33	0.000	.983	1.569	.219
	CG	15	2.33	1.05					
Total	EG	20	14.55	3.28	33	0.762	.389	.669	.508
	CG	15	13.87	2.75					

When Table 3 is examined; it is seen that there is no significant difference between the pretest mean scores of the research groups in BSS (p>.05).

Table 4 shows the results of the dependent groups t-test applied to determine whether there is a significant difference between the pretest-posttest scores of the experimental group in the study.

Table 4. *Dependent groups t-test results regarding the pretest-posttest scores of the experimental group from BSS*

	Experimental Group	n	X	ss	sd	t	*p*
Classification	Pretest	20	2.75	1.02	19	-3.343	.003*
	Posttest	20	3.75	0.55			
Measuring	Pretest	20	2.95	0.76	19	-3.621	.002*
	Posttest	20	3.65	0.59			
Observation	Pretest	20	3.35	1.14	19	-2.259	.036*
	Posttest	20	3.95	0.22			
İnference	Pretest	20	2.60	1.05	19	-3.866	.001*
	Posttest	20	3.55	0.60			
Prediction	Pretest	20	2.90	1.07	19	-3.216	.005*
	Posttest	20	3.75	0.55			
Total	Pretest	20	14.55	3.28	19	-4.882	.000*
	Posttest	20	18.70	1.42			

***p*<.05**

Looking at the data in Table 4; In the comparison of the BSS pretest posttest mean scores of the students in the experimental group, it is seen that there is a significant difference in favor of the posttest in the total score and all factors of the scale (*p*<.05).

Table 5 shows the results of the dependent groups t-test applied to determine whether there is a significant difference between the pretest-posttest scores of the control group in the BSS.

Table 5. *Dependent groups t-test results regarding the pretest-posttest scores of the control group in BSS*

	Control Group	n	X	ss	sd	t	*p*
Classification	Pretest	15	2.47	1.13	14	-.807	.433
	Posttest	15	2.73	1.16			
Measuring	Pretest	15	2.33	1.18	14	-2.000	.065
	Posttest	15	3.00	1.13			
Observation	Pretest	15	3.53	0.92	14	1.948	.072
	Posttest	15	3.00	0.85			
İnference	Pretest	15	3.00	0.76	14	0.250	.806
	Posttest	15	2.93	0.80			
Prediction	Pretest	15	2.33	1.05	14	-.367	.719
	Posttest	15	2.46	0.92			
Total	Pretest	15	13.87	2.75	14	-.430	.674
	Posttest	15	14.13	2.33			

When Table 5 is examined; It was determined that there was no significant difference in the pretest-posttest mean scores of the control group students in terms of total and factors (p>.05).

Table 6 shows the results of the independent groups t-test applied to determine whether there is a significant difference between the posttest scores of the research groups from BSS.

Table 6. *Independent groups t-test results regarding the posttest scores of the research groups from the BSS*

	Groups	n	X	ss	sd	Levene test		t	*p*
						F	*p*		
Classification	EG	20	3.75	0.55	33	23.912	.000	3.442	.002*
	CG	15	2.73	1.16					
Measuring	EG	20	3.70	0.47	33	4.502	.041	2.499	.018*
	CG	15	3.00	1.13					
Observation	EG	20	3.95	0.22	33	8.357	.007	4.828	.000*
	CG	15	3.00	0.85					
İnference	EG	20	3.55	0.60	33	0.451	.507	2.500	.019*
	CG	15	2.93	0.80					
Prediction	EG	20	3.75	0.55	33	4.087	.051	4.816	.000*
	CG	15	2.47	0.92					
Total	EG	20	18.70	1.42	33	7.905	.008	7.195	.000*
	CG	15	14.13	2.33					

***p<.05**

When Table 6 is examined; It is seen that there is a significant difference between the posttest mean scores of the research groups in BSS, in favor of the experimental group, in the total of the scale and in all its factors (p<.05).

3.2. Qualitative Results

In the research, the question “Can you evaluate the positive/negative aspects of the effect of coding education on the developmental areas of children? / Could you explain your positive/negative views on the impact of the coding education application process at school on your child's developmental areas, together with the reasons?” The answers to the question were analysed. Within the framework of the findings, it was determined that a main theme was formed as "The Effect of Material Supported Cooperative Coding Education on Development Areas in Preschool Education". It is seen that there are five different sub-themes under the main theme.

Table 7. *The effect of material supported cooperative coding education on development areas in preschool education*

	Data Sources		Total
	Teacher	Parent	
	f	f	f
Effects on Cognitive Development	6	16	22
-Developing thinking skills	1	5	6
-Developing logical thinking	1	3	4
-Developing problem solving skills	-	2	2
-Focusing	-	2	2
-Increased attention span	1	2	3
-Learning with fun	1	2	3
-Active learning	1	-	1
-Follow their instructions	1	-	1
Effects on Social Development	2	12	14
-To cooperate	1	4	5
- Improvement in communication skills	-	3	3
-Socialization	-	3	3
-Learning to share	-	2	2
-Learning to work together	1	-	1
Effects on psychomotor development	2	-	2
-Learning to control your body	1	-	1
-Balancing your body	1	-	1
Effects on Behavioral Development	1	3	4
- Interested in books	-	1	1
-Taking responsibility	1	1	2
- willing to go to school	-	1	1
Effects on the Family	-	11	11
-More efficient work	-	5	5
-Increased confidence in school	-	4	4
-Recognizing your own shortcomings	-	2	2
Toplam	11	42	53

When the findings in Table 7 are examined; It was determined that the findings obtained from teachers and parents were divided into five different sub-themes: Effects on Cognitive Development, Effects on Social Development, Effects on Psychomotor Development, Effects on Behavioral Development and Effects on Family. In the sub-theme of the effects on cognitive development, the sub-themes of improving thinking skills and developing logical thinking of the highest coding; cooperation, improving communication skills and socializing in the sub-theme of effects on social development; In the sub-theme of effects on the family, it was concluded that working more efficiently and increasing confidence in school. Sample sentences from the data that are the source of the findings obtained in the research are presented below. A parent of one of the students,

P-M-35-1 "I am very satisfied with this application at school. Children's thinking, logic development, problem solving, etc. I believe it will contribute to the development of their skills." while another said,

P-M-27-5 “The app contributed to the development of children in cooperation, sharing, focus and attention. On our behalf, we saw our shortcomings at this point and took the necessary measures.” expressed his views. Another parent is

P-M-37-7 “I find the applications made very positive. It greatly contributed to my child's socialization and cognitive development. I observe that his bond with the people around him is strengthened and he communicates better”. If the practice teacher

T-F-39-17 “In the first stages of the study, the students had difficulties in doing many commands together, but then they learned to work together, collaboratively. In their work I code with my body, they had difficulty in positioning their bodies according to the shapes on the paper. But after doing it a few times, they started to do it more comfortably. Because they did not know how to follow the instructions, the majority of students had problems in finding their direction by looking at the model and coding. I can say that one of the important achievements of the students during the process is to act according to certain rules and to use logic. Students who were inclined to work individually had problems with adaptation in group work. However, they comprehended working together by collaborating in the studies carried out within a certain time period. It was observed that the children enjoyed the activities, took responsibility for learning, and actively participated. Working with materials designed for children, suitable for their cognitive development level, improved their thinking skills, allowed them to maintain their attention span, and the activities were applied without getting bored during a lesson hour.”

When the findings obtained from teachers and parents are compared, it is seen that there are no negative answers and there is a large overlap. It can be stated that the application made in this direction supports the development areas of the students.

In the research, the question “Can you explain your views on the effect of using structured material in coding education on children's learning? / Could you explain your views on the effect of using structured materials in coding education on your child's learning?” The answers to the question were analysed. Within the framework of the findings, it was determined that a main theme was formed as "The Effects of Using Structured Materials in Preschool Education on Learning". It is seen that there are three different sub-themes under the main theme.

Table 8. *The Effects of using structured materials in preschool education on learning*

	Data Sources		Total
	Teacher	Teacher	
	f	f	f
Effects on Learning	17	27	44
-Ensuring permanent learning	1	4	5
-Supporting intelligence development	1	3	4
-Developing attention skills	1	3	4
-Developing hand skills	1	3	4
-Concrete abstract concepts	1	3	4
-Learning by trial and error	1	2	3
-Developing the world of dreams	1	2	3
-Solving everyday problems	1	2	3
-Developing sense organs	1	2	3
-Able to simulate	1	1	2
-Practice by designing in your mind	1	1	2
-Ensuring efficient work	1	1	2
-Maintain attention ability	1	-	1
-Ensuring active participation	1	-	1
-Multidimensional thinking	1	-	1
-Developing coordination skills	1	-	1
-Behaving cooperatively	1	-	1
Effects on Affective Development	3	3	6
-Enjoy learning	1	1	2
-Strengthening the bond of friendship	-	1	1
-Support the development of self-confidence	1	-	1
-Being more sensitive to the environment	1	1	2
Evaluation of Materials	3	3	6
-Like it's wooden	1	1	2
-Healthy finding	1	1	2
-Thinking that it increases awareness of nature	1	1	2
Total	23	33	56

Looking at Table 8; It is seen that the findings obtained from the participants are divided into three sub-themes: Effects on Learning, Effects on Affective Development and Evaluation of Materials. It was determined that the highest encodings were related to permanent learning, supporting intelligence development, increasing attention, improving dexterity and concretizing abstract concepts. Sample statements regarding the answers given by the participants are given below. One of the parents

P-M-37-2 "I think that learning the applications in company with the materials will provide more permanence and will also contribute to solving daily problems (by analogy)." while another said,

P-M-31-8 "Concrete concepts are always more effective. Because by touching, more efficient works are realized through trial and error." he explained his views. Yet another parent

P-M-33-12 "I think it is very beneficial for intelligence development. Being careful helped a lot in the development of hand skills. I also think that using the materials will improve the sense organs." He expressed his opinion in words. practice teacher,

T-F-39-17 “The difference between the studies we did with insufficient materials in the classroom and the ones we did with structured materials was quite clear. Students enjoyed and participated in the activities in the process. With the structured materials, a great improvement was observed in attention, keeping attention, interest and active participation in activities, versatile thinking, dexterity development, problem solving, coordination, efficient working, cooperative behavior and permanent learning skills. I also think that working with materials is beneficial in terms of students' intelligence, imagination, self-confidence, design, and analogy. I think it is among the pluses that the materials are wooden, so they are healthier. Because wood is a natural material and it increases the student's awareness of the environment.” he explained his thoughts.

When the answers given are examined, it is seen that both the teacher and the parents gave answers that support each other. It was determined that they generally thought positively about the use of structured wood materials in pre-school education.

In the research, the participants were asked to determine their views on what other achievements structured materials could be used to achieve in preschool. Can you explain why?" The answers to the question were analysed. Within the framework of the findings obtained, it was determined that a theme was formed in the form of "Other Acquisitions That Could Use Structured Material in Preschool Education".

Table 9. *Other acquisitions that could use structured material in pre-school education*

	Data Sources		Total
	Teacher	Teacher	
	f	f	f
-Developing creativity skills	1	5	6
-Using materials for multiple purposes	1	5	6
-Generate different ideas	-	3	3
-Supporting imagination	-	3	3
-Learning to share	-	3	3
-Scientific thinking	1	2	3
-Being a producer	-	2	2
-Be frugal	-	1	1
-Adapting to the environment and society	1	1	2
-Prepare for real life	-	1	1
-Developing hand skills	-	1	1
-Developing cleaning and hygiene skills	-	1	1
-Developing attention and focusing skills	1	1	2
-Supporting large and small muscle development	1	-	1
-Ensuring hand-eye coordination	1	-	1
-Learning concepts	1	1	2
-Developing reading and writing skills	1	-	1
-Empathy	1	-	1
-Social values	1	1	2
-Learning by doing	1	-	1
Total	12	31	43

In the findings in Table 9, it is seen that the answers given by the participants were evaluated together. It was determined that the highest coding obtained from the answers given by the participants was related to developing creativity skills, using materials for multiple purposes, producing different ideas, supporting imagination and learning to share.

Sample sentences from the data that led to the formation of the findings are given below. Accordingly, one of the parents

P-M-37-2 "Thanks to structured materials, I think my child can have personality traits that are curious, interested, exploratory, exploratory, that is, prioritizing scientific thinking." in the words of another,

P-M-40-6 "With these materials we make, he can sometimes perceive that a single piece can be used in many areas. She makes puppets from socks, hair from threads, rose petals from paper. He can perceive that socks can be used in other areas besides being worn. He develops in the direction of creativity by creating other fictions in the fantasy world. Now he thinks what can I do from a simple biscuit box he sees. This pushes the child to produce and think. This is how the creativity aspect develops." He expressed his opinion in words. Another parent

P-M-34-11 "It can be used normally, that is, in real life. It should be used in every field for the development of order, cleanliness, attention and hand skills. Materials are actually a very good opportunity to prepare our children for life in a way." As for the practice teacher,

T-F-39-17 "These materials can be used in games that develop large and small muscle skills, to increase attention span, facilitate focusing on the activity, and improve creativity skills. These materials will make learning fun for students who have difficulty in establishing hand-eye coordination, who have problems in learning concepts, and even upper class students to learn to read and write easily. Affective skills such as empathy, love and respect, which cover the abstract operational period, can be played with these materials, and concrete learning can be achieved by enabling the child to learn by touching, doing and experiencing. It can also be used for scientific thinking and for them to use it as a natural learning tool by perceiving different objects around them for multiple purposes. It was determined that he expressed his thoughts with his sentences.

When the views of the participants are considered together, it has been concluded that there are compatible answers and that there are opinions that structured material can be used in many motor, cognitive, social and affective acquisitions.

4. Discussion, Conclusion and Recommendations

In this research, it is basically aimed to reveal that the basic skill levels expected to be possessed by the children in the pre-school period can be gained more easily and quickly with cooperative teaching and different teaching activities. In addition, it is to make preschool students understand the basic logic of coding education, which is the first step of producing content on digital platforms, through structured materials. The quantitative findings obtained show that the implementation process is effective. In addition, it was determined that the qualitative findings were compatible with the quantitative findings and all of the participants expressed a positive opinion.

It is seen that there is no significant difference between the pretest mean scores of the research groups from the BSS. Accordingly, it can be interpreted that the basic skill levels of the students in the experimental and control groups are similar. In the study of Büyüktaşkapucu (2012) in which he investigated the effect of constructivism education on the scientific process skills of preschool students, it was concluded that there was no significant difference between the experimental and control groups. In the findings of the study conducted by Alabay and Özdoğan (2017), no significant difference was found in the pretest findings of the research groups.

In the comparison of the BSS pretest-posttest mean scores of the students in the experimental group, it is seen that there is a significant difference in favor of the posttest in the total score and all factors of the scale. It can be interpreted that the coding education applied in the experimental group positively affects the basic skills of the students. Likewise, when the results of the research conducted by Büyüktaşkapucu (2012) were examined, it was found that there was a significant difference between the pretest-posttest mean scores of the students in the experimental group, in favor of the posttest. Considering the results of Alabay and Özdoğan's (2017) study, it was seen that there was a significant difference between the pretest-posttest scores of the students in the experimental group, in favor of the posttest. It was determined that there was no significant difference in the pretest-posttest mean scores of the control group students in terms of total and factors. When the results of Alabay and Özdoğan's (2017) study were examined, it was seen that there was no significant difference between the pretest-posttest scores of the students in the control group. In the findings of the study conducted by Büyüktaşkapucu (2012), a significant difference was found between the pretest-posttest scores of the control group in terms of other factors except the measurement factor.

It was determined that there was a significant difference between the posttest mean scores of the research groups in BSS, in favor of the experimental group, in the total of the scale and in all its factors. Considering the findings of the study conducted by Alabay and Özdoğan (2017), it is seen that there is a significant difference in favor of the experimental group, similar to this study. Although there was a significant difference in the scores of the students in both the experimental and control groups in the pretest-posttest comparison of the study conducted by Büyüktaşkapucu (2012), it was seen that there was a significant difference in favor of the experimental group in the comparison of the posttest scores of the groups.

It was determined that the findings obtained from teachers and parents were divided into five different sub-themes: effects on cognitive development, effects on social development, effects on psychomotor development, effects on behavioral development and effects on family. In the sub-theme of the effects on cognitive development, the sub-themes of improving thinking skills and developing logical thinking of the highest coding; cooperation, improving communication skills and socialization in the sub-theme of effects on social development; In the sub-theme of effects on the family, it was concluded that working more efficiently and increasing confidence in school. It is seen that the findings obtained from the participants are divided into three sub-themes: effects on learning, effects on affective development and evaluation of materials. It was determined that the highest encodings were related to permanent learning, supporting intelligence development, increasing attention, improving dexterity and concretizing abstract concepts. It is seen that the answers given by the participants are evaluated together. It was determined that the highest coding obtained from the answers given by the participants was related to developing creativity skills, using materials for multiple purposes, producing different ideas, supporting imagination and learning to share.

In the study carried out by Kasalak (2017), it was determined that coding activities achieved much more than what they could achieve individually by doing collaborative teaching, it supports students' more efficient learning, enables them to learn with fun, enables them to embody soft information, and affects their active and willing participation in the process. In the study conducted by Rusk, Resnick, Berg, & Pezalla-Granlund (2008), it was determined that the students learned while having fun in the findings obtained from the interview and observation forms. In the studies conducted, it is seen that the qualitative findings obtained in this study regarding coding education and coding education support it. Wachenchauzer (2004) and Casey (1997) stated that coding education improves cognitive

thinking skills; Jenkins (2002) states that it provides students' willing, active and active participation; Büyüktaşkapucu (2012), Alabay and Özdoğan (2017) determined that it provides permanent learning. In the research findings of Göksoy and Yılmaz (2018), it has been determined that there are opinions that robotic coding education is fun, improves creativity and thinking skills, supports multidimensional perception, affects intelligence positively, ensures active participation in the lesson and coordinated work, and increases academic success. In addition, it has been concluded that coding education has positive effects in terms of using imagination, logical/algorithmic thinking, designing, analytical thinking, identifying problems quickly, working efficiently, and understanding information. Studies have found that coding education has effects not only on the cognitive domain but also on the affective domain. Ceylan and Gündoğdu's (2018) study found that coding education increased students' motivation for the lesson, improved their self-confidence, and increased their communication skills.

Initiating coding education, which is one of the 21st century skills, from early childhood is really important in terms of raising the individuals of the future ready for the changing world. Coding education is not just learning how to write code. The basic logic in coding education is to develop students' thinking skills in the information-processing dimension (Brennan & Resnick, 2012). With the coding education initiated at an early age, students are supported to discover and develop themselves. The foundations of high-level thinking skills such as analytical thinking, abstract thinking, logical thinking, critical thinking, and problem solving are laid (Akpınar & Altun, 2014; Kalelioğlu & Gülbahar, 2014). Of course, the contribution of a generation with advanced thinking skills to the society in which they live in the future will be at a high level. For this reason, coding education is given or thought to be given in early childhood in many countries (Bocconi, Chioccariello, Dettori, Ferrari, & Engelhardt, 2016). In fact, some researchers think that coding education should be given in the early period due to the economic future of countries (Kafai, Burke, & Resnick, 2014).

Developing the basic skills of classification, measurement, observation, inference and estimation of children in early childhood supports the development of scientific thinking processes. Education and activities in different fields are of great importance for the development of these skills. In this study, the effect of coding education on the development of basic skills of pre-school children aged 60-72 months was investigated and it was found that it had a positive effect. In addition, it was determined that there were positive findings in the qualitative data related to coding education. Of course, concrete materials are important in teaching even the first steps of an abstract concept such as coding. It is important that these materials serve their purpose, be simple in structure, and do not contain elements that will threaten the health of students. In addition, it should be chosen according to the structure of the study. The materials used in this study, which was carried out with the method of cooperative learning, were originally designed in accordance with group work and were produced from natural wood materials. Researchers need to contribute to the literature by designing and applying new and original materials in their studies. The number of studies on coding and foundation in early childhood is limited. Each new study will be a resource for curriculum developers and researchers by providing the development of a holistic perspective in terms of results. The effect of coding education on different skills should also be investigated and presented with both quantitative and qualitative findings. Considering the fact that cooperative learning positively supports not only cognitive but also other developmental areas, it is recommended to be used more widely in pre-school education.

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