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The Effect of Block Based Coding Education on the Students' Attitudes about the Secondary School Students' Computational Learning Skills and Coding Learning: Blocky Sample

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The aim of this study is to examine the effect of block-based coding education on middle school students' computational thinking skills and attitudes towards coding with Blocky example. The training phase of the implementation process was planned and implemented by subject experts in 4 weeks and 2 hours a week. In the research, both quantitative and qualitative research methods and exploratory sequential design were used as mixed methods. In this study, quantitative research method and pre-test- post-test control group semi-experimental pattern model was used as the research model. The universe of the study consists of 5th grade students studying at a secondary school in Aksaray province Eskil district of Türkiye in the 2019-2020 academic year. Within the scope of the research, the research participant group was determined considering that 5th grade students will receive coding training for the first time. In addition to the total number of students to be reached is 38, including 19 control and 19 experimental groups. While the "blocky" application used in block-based coding education was determined as the independent variable in the research, the students' computational thinking skills and their attitudes towards learning to code were determined as dependent variables. As a result of the applications and analysis, the difference between the values of students' computational thinking skills self-efficacy and attitudes towards learning coding before and after education is statistically significant. In order to determine the effect size of the Blocky block-based coding environment on the Information Computational Thinking Skills Self-Efficacy Scale (CTSES) and the Attitudes Toward Learning Coding Scale (ATLCS), the eta squared value was examined. It can be said that the Blocky block-based coding environment has a "large" effect size on computational thinking skills, self-efficacy perception and on the attitude towards learning coding.

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Introduction

One of the most important effects of technologies, which has an impact on all areas of our lives, and on individuals is some novel skills in individuals are required (Ramazanoğlu, 2021). Developments in the field of technology brought some needs together, paving the way for the concept of the emergence of 21st century skills (Bülbül Şoltan, 2018). Learners should be trained by gaining knowledge and skills for the needs of the age. Individuals are expected to have skills such as critical and algorithmic thinking, problem solving and the ability to adapt solutions to similar situations (Scot, 2018). Individual with 21st century skills; is an individual who can solve problems, adapt solutions to different problems, productive, lifelong learner and go beyond what he learns in the classroom (Gülbahar, Kert & Kalelioğlu, 2019). Computational Thinking (CT) skill, which is a new concept, is also in the 21st century shown among the skills. International Education Technology Association (2014) (The International Society for Technology in Education- ISTE) expresses that CT is an expression of critical thinking, creative thinking, algorithmic thinking, problem solving and collaborative learning. It is also possible to define CT as a way to design systems, solve problems, and understand computer science and human behaviour (Yağcı, 2018).

When we look at the definitions of computational thinking, which teaches individuals the solutions by dividing big problems into small and solvable parts, it is seen that the sub-skills and the skills expected from the students in the information age coincide with each other (Oluk, Korkmaz & Oluk, 2018). Considering the effectiveness of CT in daily life skills and the 21st century skills it provides to learners, its integration into education curriculum is very important. CT is a skill that also supports project-based teaching processes in which interdisciplinary approaches are used, especially in the fields of mathematics, science, and computer (Gülbahar, Kalelioğlu, Doğan & Karataş, 2020). Technology-supported studies are carried out in areas such as game design, robotics and coding to help students gain CT and 21st century skills (Tutulmaz, 2019). As a coding concept, which came to the agenda in the development of 21st century skills in students; It can be defined as having the desired jobs done to the computer by using some commands (Akkaş Baysal, Ocak & Ocak, 2020).

CT skill is defined as creating the solution of any problem in steps (algorithm), associating the solution with similar problems (creating patterns), dividing complex problems into solvable sub-parts (decomposing the problem) and having the support of computers in solving problems (automation) (Yadav, Hong & Stephenson, 2016). Along with CT, the skills that learners gain are directly related to algorithm logic and coding education. Resnick (2013) emphasizes that learning to code besides gaining CT skills also provides individuals with competencies such as problem solving, project creation and communication strategies, and these skills are important for everyone regardless of the age, profession, and interests of individuals. It is thought that coding education taken at an early age can also support the mental development of the individual (Demir & Demir 2021). 4.2 million people and more than 80 countries participated in the European Code Week (EU-CodeWeek) organized by the EU worldwide in order to raise awareness in the field of coding and to improve the coding ability of individuals. (CodeWeek, 2020). The Information Technologies and Software course, which is given in primary education in our country, allows students to code within the scope of the course.

Coding education includes some problems such as the coding environment suitable for the target audience, teaching method and programming language (Erdem, 2018). Programming languages' own spelling rules and abstract conceptual patterns can cause learners to have difficulties at first (Bala, 2019). In order to eliminate this problem, block-based programming (BBP) environments / tools that prioritize visuality and are easier to learn have been developed (Çatlak, Tekdal & Baz, 2015; Yılmaz İnce, 2020). Considering the ages of primary school students, BBP create a more interesting learning environment for students (Uzunboylar, 2017). BBP environments are compilers where students create animations and games by combining code blocks with drag and drop method just like a puzzle piece, and learn with fun (Esgil & Gündüz, 2019; Haymana & Özalp, 2020).

Blocky, a block-based programming tool to be used in research contains puzzles and blocks of code to complete puzzles. It was preferred in terms of being free of charge and suited to the level of the students.

Purpose of the research

The aim of the study is to examine the effect of block-based coding education in Information Technologies and Software course on middle school students' CT skills self-efficacy and attitudes towards coding learning. For this purpose, answers will be sought for the following sub-purposes.

In relation to Block-based coding training:

- Do the students' scores obtained from the applied CTS (Computational Thinking Skill) skill self-efficacy perception scale show a significant difference in the post-tests compared to the pre-tests?
- Do the students' scores from the attitude scale towards coding education applied show a significant difference in the post-tests compared to the pre-tests?

The importance of research

As our lives become technology-oriented, it is necessary to teach children how to develop computer programs themselves, rather than teaching them how to use technological devices. In our age, great importance is attached to coding education and many countries are initiating studies on providing students with CT skills with coding education. With CT, students can expand the limits of thinking by automating their solutions with computers and solving problems more effectively (Gülbahar, Kert & Kalelioğlu, 2019). CT is a skill that concerns everyone, not just computer scientists or mathematicians, and should be acquired from early childhood (Wing, 2006; 2008).

It is thought that the training given to individuals in the field of software provides the technological development of countries (Yılmaz İnce, 2020). When PISA results are examined, countries such as Finland, New Zealand, England, and the USA show rapid progress in providing students with the skills of the age by including coding training in their curricula (Akpınar & Altun, 2014). In our country, coding education is included in the Information Technologies and Software course curriculum, which is taught in the compulsory 7th and 8th grades in 5th and 6th grades.

Students' learning of complex concepts within the scope of coding activities may bring along many problems and cause them to develop a negative attitude towards coding. The lack of conceptual knowledge in students combined with the rules of the programming language used may cause difficulties in coding processes (Kalelioğlu, 2015). Many actions and concepts remain abstract for learners, especially in the coding teaching process of children who are in the pre-operational and concrete operational period (Ersoy, Madran & Gülbahar, 2006).

For this reason, teaching children their first coding experiences in an entertaining way supported by different methods will enable them to learn the complex programming languages and logical reasoning they will encounter in the future (Scharf, Winkler & Herczeg, 2008). Block-based coding is seen as a more fun way to study coding with blocks and graphics representing them instead of complex textual expressions (Çavdar, 2018). Some of the online image-based platforms are: ScratchJr, Code.org, Mblock, and Blocky.

It is anticipated that this study will contribute to the field in terms of the effect of block-based tools on the CT skills and students' coding attitudes and blocky issues in coding teaching and will be a guide for new studies to be conducted.

Method

In this section, the method used in the research is discussed.

Research Design

The mixed method was adopted in this study, in which the effect of block-based coding education on middle school students' attitudes towards CT skills and coding learning was investigated. The mixed method is described as a research method in which quantitative and qualitative methods are used together in a single study and their approaches are combined (Johnson & Onwuegbuzie, 2004).

In the study, quantitative data were collected through the computational thinking skill self-efficacy perception scale and the attitude towards learning coding scale, and the qualitative data were collected with the opinion form about the learning process developed by the researcher. The research is in a trial model due to the investigation of its effect on students from different angles. Trial models are research models in which data to be observed directly under the control of the research are produced in order to try to determine cause-effect relationships (Karasar, 2009). A quasi-experimental method consisting of repeated measurements with pre-test-post-test control group will be applied. In the studies in which the experimental design with pre-test and post-test control groups was used; It is applied in academic studies by subjecting the subjects to measurements related to the dependent variable both before and after the research application. It is the most frequently used pattern by researchers, especially in studies conducted in the field of educational technology (Kılıç-Çakmak et al., 2013). Participants are divided into two groups as experimental and control groups in the studies in the experimental design with pre-test-post-test control groups. The groups are randomly determined as one experimental group and one control group. During the process, it was planned to give 6-week blocky training to experimental group students within the scope of block-based coding. The control group continued teaching within the annual plan. In this context, quantitative data were collected by applying pre-tests and post-tests for students' CT skills, self-efficacy perceptions and attitudes towards learning coding.

In the study, the independent variable was determined as the "blocky" application used in block-based coding education. Dependent variables in the study are computational thinking skills and attitudes towards learning coding. The quasi-experimental design for research is shown in Table 1.

Table 1. Semi-Experimental Design of Research Model

Group	Pre-Test	process	Post-Test
E	O_1	X_{BLC}	O_2-N_G
C	O_1	X_G	O_2

E = Experimental group
C = Control group
XBLC = Coding teaching with Blocky application
XG = Coding teaching given with traditional teaching methods
O1 = Experimental and Control group pre-test application
O2 = Experimental and Control group post-test application
NG = Collecting qualitative data from experimental group students

Participants

The universe of the study consists of 5th grade students studying at a secondary school in Aksaray province Eskil district in the 2019-2020 academic year. Within the scope of the research, the target audience was determined considering that 5th grade students will receive coding training for the first time.

Table 2. Percentage Frequency Information of Participants

Groups	N	%
Experimental group	19	50,0
Control group	19	50,0
Total	38	100,0

When the table is examined, the total number of students to be reached is 38, including 19 control and 19 experimental groups (Table 2).

Table 3. Gender Distribution of Participants Percent Frequency Table

	Girl		Boy		Total	
Groups	f	%	f	%	f	%
Experimental group	10	52,6	9	47,3	19	100,0
Control group	10	52,6	9	47,3	19	100,0
TOTAL	20	52,6	18	47,3	38	100,0

When the table is examined, the total number of students to be reached is 38, of which 52.6% (N = 20) are female and 47.3% (N = 18) are male (Table 3).

Table 4. Participants' Internet Connection Percentage Frequency Table

Internet Connection Status	N	%
Yes	15	39,5
No	23	60,5
TOTAL	38	100,0

When the table is examined, 39.5% of the participants have internet access while 60.5% do not have internet access (Table 4).

Table 5. Tablet / Phone / Computer Ownership Status of Participants Percentage Frequency Table

Tablet / phone / computer Ownership Status	N	%
Yes	21	55,3
No	17	44,7
TOTAL	38	100,0

When the table is examined, it is seen that 55.3% of the participants have any of the tools such as tablet / phone / computer, while 44.7% do not have any of these tools (Table-5).

Table 6. Tablet / Phone / Computer Daily Usage Times of Participants Percentage Frequency Table

Daily ICT usage time	N	%
0-3 hours	22	57,9
3-6 hours	14	36,8
6 hours or more	2	5,3
TOTAL	38	100,0

When the table is examined, it is seen that 57.9% of the participants use ICT tools for 0-3 hours a day, 36.8% for 3-6 hours, and 5.3% for 6 hours or more (Table-6).

Data Collection Tools

Three different data collection tools were used in the study. In order to measure the effectiveness of the teaching process, an opinion form about the learning process developed by the researcher was used. In addition, two different scales were used to measure computational thinking skills, self-efficacy perception and attitude towards coding. A section where demographic information will be collected and research information will be provided has been added to the scales and the opinion form.

Opinion statement form regarding the learning process

This measurement tool, developed by the researcher, was used to collect data about students' feelings and attitudes regarding the learning process. During the preparation process of the "Opinion Form for the Learning Process", the opinions of two Turkish teachers and three ICT teachers were taken, and the necessary arrangements were made and the final form consisting of 13 items was created. Form, "Was the lesson fun for you?", "Would you like to develop yourself in coding in the following processes and design a game?" It contains questions such as. The students were presented with two answer options as yes or no.

Self-efficacy perception scale for computational thinking

In the study, REIC scale developed by Gülbahar, Kert and Kalelioğlu (2019) was used to measure students' computational thinking skills self-efficacy. The scale is in the triple Likert type with the options of "yes", "partially", "no" and consists of 36 items. According to the results of the exploratory factor analysis performed on the scale, the REIC consists of five sub-dimensions. These dimensions are; “Algorithm Design Competence” consisting of 9 items, “Problem Solving Competence” consisting of 11 items, “Data Processing Competence” consisting of 7 items, “Basic Programming Competence” consisting of 6 items and “Self-Confidence Competence” consisting of 6 items. As a result of the analysis, the total reliability coefficient (Cronbach alpha) of the scale was found as 0.94. Necessary permission has been obtained for the use of the scale.

Attitude scale towards coding education

In the study, an attitude scale towards coding education developed by Karaman and Büyükalan Filiz (2019) was used to measure students' attitudes towards coding education. The attitude scale, prepared in the five-point likert type such as "strongly disagree", "disagree", "partially agree", "agree", "strongly disagree", consists of 41 items. In the 2018-2019 academic year, 503 students studying at 5 different secondary schools in Keçiören district of Ankara province were analyzed. As a result of the analysis, the Kaiser-Meyer-Olkin (KMO) value was found to be .96 and this value was found to be at an acceptable level. As a result of EFA, it was determined that the variance explained for the 2-factor structure for a total of 41 items was 47.89%. The scale consists of two dimensions: "General Positive Attitude towards Coding Education" consisting of 28 items and "General Negative Attitude towards Coding Education" consisting of 13 items. There are no reverse-coded items in the scale. Necessary permission has been obtained for the use of the scale.

Data analysis

During the data analysis process, the demographic information of the study group and their responses to the measurement tools were checked for validity and transferred to the computer environment. Demographic data of the study group are presented with descriptive statistics such as percentage and frequency, arithmetic mean, and standard deviation. SPSS (Statistical Package for the Social Sciences) package program was used to analyze the quantitative data obtained from pre-tests and post-tests. Findings were tested at 0.95 confidence ($p = 0.05$) level. T-test was used for related samples in the study. The t-test was used for the related samples to compare the data collected from the pre-test applied before the research and the post-test applied after the research of the students who went through the experimental process. The t-test for unrelated samples is used to test whether the difference between two unrelated sample means is significant (Büyüköztürk, 2011). Content analysis method was used to analyze qualitative data. In the content analysis method, questions and answers in qualitative research are brought together and grouped in a way that they are related to each other (Özdemir, 2010).

Pre-implementation data analysis

The results of the comparison (independent t-test for unrelated samples) of the results of the self-efficacy scale for computational thinking skill and the attitude scale towards coding education applied to the experimental and control groups before the application (pre-tests) are given in Table 7 and Table 8.

Table 7. Pre-test Comparison Results of the Self-Efficacy Scale for Intergroup Information Computational Thinking Skill

	Groups	N	$\overline{X}$	Sd	Df	T	p
Pre-Test	Experimental group	19	73,78	11,83	36	1,579	,123*
	Control group	19	67,94	10,94			

*p<0.05

After determining the experimental and control groups before the application, in the pre-tests performed on the experimental and control groups (experimental group pre-test average = 73.78; control group pre-test average = 67.94) * p <.05 for the significance level .05 <p does not make sense for it.

Table 8. Pre-Test Comparison Results of the Attitude Scale Towards Intergroup Coding Education

	Groups	N	$\overline{X}$	Sd	Df	t	p
Pre-test	Experimental group	19	135,47	16,53	36	,268	,790*
	Control group	19	133,89	19,68			

*p<0.05

In the pre-tests performed on the experimental and control groups before the application (experimental group pre-test average = 135.47; control group pre-test average = 133.89) * p <.05 for the significance level, it is not significant since it is .05 <p. In other words, it was determined that the groups were equal before the research with these results obtained from the statistical tests and the equal numbers of the study groups.

Results

In this section, the research questions, the results of the statistical analysis made according to the data collected from the research, and the comments regarding the research questions are presented. Cronbach's Alpha reliability coefficient, which is an internal reliability coefficient, was found to be .870 in the reliability test conducted with the data collected from the study group after the application of the Information Process Thinking Skill Self-Efficacy Scale. Cronbach's Alpha reliability coefficient, which is an internal reliability coefficient, was found to be .847 in the reliability test conducted with the data collected from the study group after the implementation of the Attitude Scale towards Coding Education.

Quantitative findings regarding the research

Experimental Group Pre-test- Post-test Comparison

As a result of the application, the comparisons of the pre-test and post-tests conducted in order to determine the status of the experimental group students regarding the CT skill are given in Table 9.

Table 9. Experimental Group Pre-test-Post-test Comparison Results for the Self-Efficacy Scale For Computational Thinking Skill

	Test	N	$\overline{X}$	Sd	Df	t	p
Experimental group	Pre-test	19	73,78	11,83	18	27,16	.000
	Post-test	19	135,47	16,53			

*P<0.05

It was observed that there was a statistically significant difference between the experimental group pre-test and post-test scores (pre-test average = 73.78; post-test average = 135.47) for p <.05 significance level (p <0.05). It was determined that the experimental group students increased their self-efficacy towards the CT skill after the block-based coding training in the Blocky environment in which they participated (Table-9).

Experimental Group Pre-test- Post-test Comparison

As a result of the application, the result of the comparison of the pre-test and post-tests performed in order to determine the attitudes of the experimental group students towards coding education is given in Table 10.

Table 10. Experimental Group Pre-test-Post-test Comparison Results for the Scale of Attitude Towards Coding Education

	Test	N	$\overline{X}$	Sd	Df	t	p
Experimental group	Pre-test	19	96,84	7,25	18	58,15	.000
	Post-test	19	163,10	16,69			

*P<0.05

It was observed that there was a statistically significant difference between the experimental group pre-test and post-test scores (pre-test average = 96.84; post-test average = 163.10) for * p <.05 significance level (p <0.05). It was determined that the attitude scores of the students towards coding education increased after the block-based coding training in the Blocky environment in which the experimental group students participated (Table-10).

Control Group Pre-test- Post-test Comparison

As a result of the application, the results of the comparison of the pre-tests and post-tests conducted in order to determine the status of the control group students regarding the CT skill are given in Table 11.

Table 11. Control Group Pre-test-Post-test Comparison Results for the Self-Efficacy Scale For Computational Thinking Skill

	Test	N	$\overline{X}$	Sd	Df	t	p
Control Group	Pre-test	19	67,94	10,94	18	27,05	,000
	Post-test	19	133,89	19,68			

*p<0.05

It was observed that there was a statistically significant difference between the pre-test post-test scores of the control group (pre-test average = 67.94; post-test average = 133.89) for * p <.05 significance level (p <0.05). As a result of the computer-free block-based coding training application that the control group students participated in, it was determined that there was a significant difference in their self-efficacy perceptions for the CT skill (Table-11).

Control Group Pre-test- Post-test Comparison

As a result of the application, the results of the comparison of the pre-tests and post-tests performed in order to determine the attitudes of the control group students towards coding education are given in Table 12.

Table 12. Control Group Pre-Test-Post-Test Comparison Results for the Scale of Attitude Towards Coding Education

	Test	N	$\overline{X}$	Sd	Df	t	p
Control Group	Pre-test	19	81,68	10,00	18	35,60	.000
	Post-test	19	143,57	19,00			

*p<0.05

It was observed that there was a statistically significant difference between the pre-test post-test scores of the control group (pre-test average = 81.68; post-test average = 143.57) for * p <.05 significance level (p <0.05). As a result of the computer-free block-based coding training application that the control group students participated in, it was determined that there was a significant difference between students' attitudes towards coding education (Table-12).

Experimental-Control Group Post-tests Comparison (independent t test)

The result of comparing the post-test scores of the computational thinking skill scale of the students (experimental group) and those who do not (control group) using the Blocky environment in block-based coding education is given in Table13.

Table 13. Intergroup (Experimental-Control Group) Post-Test Comparison Results for the Self-Efficacy Scale For Computational Thinking Skill

	Groups	N	$\overline{X}$	Sd	Df	t	p
Post-test	Experimental group	19	96,84	7,25	36	5,34	.000*
	Control group	19	81,68	10,00			

*p<0.05

In the post-tests performed on the experimental and control groups after the application, it is significant since it is .00 <.05 for the * p <.05 significance level. In the Post-tests performed (experimental group Post-test average = 96.84; control group Post-test average = 81.68), it was observed that the Post-test scores of the experimental group were higher than the Post-test scores of the control group (Table-13). In order to determine the effect size of the Blocky environment on the CT skill, the eta squared value was examined. The effect size value was calculated as $\eta 2$ =.126. Considering the effect size value ($\eta 2$ = 0.126), it can be inferred that the Blocky environment has a "large" effect size on the self-efficacy perception for the CT skill.

Experimental-Control Group Post-tests Comparison (independent t test)

The result of the comparison of the post-test scores of the attitude scale towards coding education of the students (experimental group) and those who do not (control group) using the Blocky environment in block-based coding education is given in Table 14.

Table 14. Intergroup (Experimental-Control Group) Post-Test Comparison Results For the Scale of Attitude Towards Coding Education

	Groups	N	$\overline{X}$	Sd	Df	t	p
Post-test	Experimental group	19	163,10	16,69	36	3,36	.002*
	Control group	19	143,57	19,00			

*p<0.05

In the post-tests performed on the experimental and control groups after the application, it is significant since it is .00 <.05 for the * p <.05 significance level. In the Post-tests performed (experimental group Post-test average = 163.10; control group Post-test average = 143.57), it was observed that the Post-test scores of the experimental group were higher than the Post-test scores of the control group (Table-14). According to this result, it can be said that the application carried out is in favor of the experimental group. In order to determine the effect size of the Blocky environment on students' attitude towards coding education, the eta squared value was examined. The effect size value was calculated as η2 =.121. Considering the effect size value (η2 = 0.121), it can be said that the Blocky environment has a "large" effect size on students' attitudes towards coding education.

Qualitative findings regarding the research

In order to support the quantitative data obtained as a result of the research and to have information about the efficiency of the learning process, an opinion form was applied to the experimental group students after the Post-tests. The data belonging to the form are indicated in the table-15 with percentage and frequency values.

Table 15. Experimental Group Students' Views on the Learning Process

		N	%
1- Did you encounter any difficulties in the problem-solving process in the lesson?	*Yes*	5	26,4
	No	14	73,6
2- Was the lesson fun for you?	*Yes*	17	89,4
	No	2	10,6
3- Did you feel happy during the lesson?	*Yes*	16	84,2
	No	3	15,8
4- Was the lesson interesting?	*Yes*	18	94,7
	No	1	5,3
5- Would you like to have this lesson again?	*Yes*	19	100
	No	0	0
6- Did you get confused during the lesson?	*Yes*	4	21,1
	No	15	78,9
7- Are there any things you could not ask during the lesson?	*Yes*	1	5,3
	No	18	94,7
8- Did you feel inadequate during the lesson?	*Yes*	3	15,8
	No	16	84,2
9- Did any situations bother you during the lesson?	*Yes*	0	0
	No	19	100
10-Did you have moments when you got bored with the lesson?	*Yes*	0	0
	No	19	100
11-Do you think what you obtained from this lesson will positively affect your success in other lessons?	*Yes*	18	94,7
	No	1	5,3
12-Would you like to develop yourself in coding and in designing a game in the next period?	*Yes*	17	89,4
	No	2	10,6

When Table 15 is analyzed, almost all of the students answered “Yes” to 6 questions in which positive attitudes were measured. In item 5, "Would you like to take this lesson again?" All of the students answered yes to the question. Almost all of the students answered “No” to 6 questions in which negative attitudes were measured. In item 9, "Did any situations bother you during the lesson?" and in the 10th item, "Did you get bored with the lesson?" All of the students answered "No" to the question. 94.7% of the students answered "Yes" to the item related to whether the course is interesting or not. In addition, the students answered “Yes” with a rate of 94.7% to the 11th item and stated that they thought that what they learned in this lesson would positively affect their success in other lessons. When the answers given to the questions with negative attitudes were examined, it was seen that there was no situation in which the students had hesitation in asking the incomprehensible points during the lesson. When Article 6 is examined, it is seen that 78.9% of the students do not experience confusion during the lesson. The situation in which no answers were given the most to the questions with a positive attitude was "Did you feel happy during the lesson?" With a rate of 15.8%. has been a question. The case with the highest rate of yes to questions with negative attitudes was "Did you encounter difficulties during the problem-solving process in the lesson?" With a rate of 26.4%. has been a question.

Conclusion and Discussion

In this section, the results obtained in line with the findings obtained as a result of the study are discussed together with the results in the literature. The demographic data of 38 students who make up the study group of the research are as follows:

- The students consist of the 5th grade and 20 of them are girls and 18 are boys.

- While 15 of the students have an internet connection at home, 23 students do not have an internet connection at their home.
- While 21 of the students have any of the ICT tools such as tablet / phone / computer, 17 students do not have any of these tools.
- Students' daily use of ICT tools are grouped as 0-3 hours, 3-6 hours and 6 hours and above. 22 of the students use ICT tools for 0-3 hours a day, 14 for 3-6 hours, and 4 for 6 hours or more.

Within the scope of the research, according to the information obtained from the feedback form applied to the students in order to evaluate the effectiveness of the process after the block-based coding teaching with Blocky given to the experimental group:

- *"Did you encounter difficulties in your problem-solving process in the lesson?"* While 5 students answered yes to the question, 14 students answered no.
- *"Was the lesson fun for you?"* While 17 students answered yes to the question, 2 students answered no. Fidan (2016) stated in her study that with coding, students' motivation and participation in the course increased, thus making the process more enjoyable.
- *"Did you feel happy during the lesson?"* While 16 students answered yes to the question, 3 students answered no.
- *"Was the lesson interesting?" While 18 students answered yes to the question, 1 student answered no.*
- *"Would you like to take this lesson again?"* all of the students answered yes to the question. In studies examining students' perceptions of the coding course, it was observed that students were willing and interested in coding activities (Kasalak, 2017).
- *"Did you get confused during the lesson?"* While 4 of the students answered yes to the question, 15 of them answered no.
- *"Are there any things you could not ask during the lesson?"* While 1 of the students answered yes to the question, 18 of them answered no.
- *"Did you feel inadequate during the lesson?"* While 3 of the students answered yes to the question, 16 of them answered no. In the study of Çavdar (2018), in which he evaluated the online environments used in coding teaching, students stated that they felt themselves largely competent in the coding course and that there was no disturbance during the course.
- *"Did any situations bother you during the lesson?"* It was observed that all of the students answered no to the question.
- *"Did you have moments when you got bored with the lesson?" It was observed that all of the students answered no to the question.*
- *"Do you think that what you learn from this lesson will positively affect your success in other lessons?" While 1 of the students answered no to the question, 18 of them answered yes.*
- *"Would you like to develop yourself in coding and design a game in the next period?"* While 17 of the students answered yes to the question, it was observed that 2 students answered no. In his research, Tağci (2019) observed the effect of coding education on primary school students and stated that students want to develop their skills in this field and make their own games after the education.

T-test was used for related samples to compare the data collected from the pre-test applied before the research and the post-test applied after the research. The results were analyzed at the significance level of p = 0.05.

As a result of the application, it was determined that the self-efficacy perceptions of the experimental group students towards the computational thinking skill increased after the blocky-based coding training with blocky (Table-9). It was observed that there was a statistically significant difference between the experimental group pre-test and post-test scores (pre-test average = 73.78; post-test average = 135.47) for $p < .05$ significance level ($p<0.05$). Lye & Koh (2014) stated in their study that coding teaching is the most effective way in gaining CT skills. However, in the study conducted by Şimşek (2018) aiming to examine the effect of robotic applications and Scratch on the CT skill and academic achievement in programming education, the opposite results were achieved. Uslu, Mumcu, and Eğin (2018) examined the effect of visual-based coding activities on the RF skill in their study, and it was concluded that there was no statistically significant difference on the RF skills, but students' imagination could be developed with coding.

The question that there is a significant increase in the attitudes of block-based coding education students towards coding education with the block in which the experimental group students participated (Table-10). It was observed that there was a statistically significant difference between the experimental group Pre-test-Post-test scores (Pre-test mean = 96.84; Post-test mean = 163.10) for $p < .05$ significance level ($p < 0.05$). There are studies in the literature that support this result. Genç and Karakuş (2011) stated that while BTP environments develop the systematic and logical thinking skills of young people who are new to coding, they increase their curiosity and increase their self-confidence. Weintrop & Wilensky (2015) states in their research that students say that block-based programming (BBP) environments are a learning environment designed for newcomers to coding and that BBP is the same but simpler than normal coding processes.

When the post-test scores of the computational thinking skill self-efficacy scale of the students (experimental group) and those who do not (control group) using the Blocky environment in block-based coding education, it was determined that the experimental group students' scores increased (Table-13). It is significant since it is $.00 < .05$ for $p < .05$ significance level in the post-tests performed on the experimental and control groups after the application. In the Post-tests performed (experimental group Post-test average = 96.84; control group Post-test average = 81.68), it was observed that the Post-test scores of the experimental group were higher than the Post-test scores of the control group (Table-13). Based on this result, it can be said that the application is in favor of the experimental group. In addition, the effect size value was found as $\eta 2 = .126$ with the eta squared value examined in order to determine the effect size of the Blocky environment on the CT skill. In this case, considering the effect size value ($\eta 2 = 0.126$), it can be inferred that the Blocky environment has a "large" effect size on the self-efficacy perception for the CT skill. Numanoğlu and Keser (2017) reached similar results in their study, in which they aimed to investigate the usability of block-based coding platforms in programming teaching and the structure of these platforms. As a result of the study, it was seen that abstract concepts can be concretized in coding teaching with block-based software and learners can rapidly improve their skills such as problem solving and CT. Rose, Habgood & Jay (2017) also reached similar results in their study. In the study, students' approaches to programming with ScratchJr and Lightbot block-based tools and their effect on CT were examined. At the end of the research, it was concluded that the performances of both versions of the application were similar. In future research, it has been suggested that the contribution of these tools to the development of skills such as algorithmic thinking, decomposition, and abstraction, as well as their contribution to the CT should be discussed in detail. Oluk et al. (2018) aimed to examine the effect of Scratch, another block-based coding tool, on algorithm development and CT skills. In this study, which was conducted with experimental and control groups, while education was carried out with the current curriculum in one of the groups, the Scratch environment was used in the other. As a result of the research, it was seen that the CT skills of the students differed significantly in the lesson with Scratch compared to the other group. In his study, Ünsal (2020) examined the effect of the use of block-based environments at the primary school 2nd grade level on the CT skill with the example of Code.org, and concluded that the processing of coding lessons with application-weighted block-based environments such as code.org is effective in the development of the CT skill. A similar study was conducted with Minecraft visual-based coding lessons, and it was concluded that these activities increased the BID skills of students (Kutay, 2020).

When the Post-test scores of the attitude scale towards coding education were compared between the students (experimental group) and those not using the Blocky environment in block-based coding education, it was determined that the experimental group students' scores increased (Table 14). In the post-tests performed on the experimental and control groups after the application, it is significant since it is .00 <.05 for the * p <.05 significance level. In the Post-tests performed (experimental group Post-test average = 163.10; control group Post-test average = 143.57), it was observed that the Post-test scores of the experimental group were higher than the Post-test scores of the control group (Table 14). Based on this result, it can be said that the application carried out is in favor of the experimental group. In addition, the effect size value was found to be $\eta 2$ = .121 with the eta squared value examined in order to determine the effect size of the Blocky environment on students' attitude towards coding education. In this case, considering the effect size value ($\eta 2$ = 0.121), it can be inferred that the Blocky environment has a "large" effect size on students' attitudes towards coding education. Bishop-Clark, Courte & Howard (2007) obtained similar results in their research using the Alice coding application. According to the post-tests applied after the education given for two and a half weeks, it was determined that there was a significant increase in the students' level of understanding of programming concepts, their self-confidence, and the pleasure they received from programming education. In another study, it was concluded that Scratch, which is widely used in block-based coding environments, has a positive effect on coding training and children's perceptions of learning to code (Zuckerman, Blau & Monroy-Hernández, 2009). In her research, Tağci (2019) stated that visual coding tools increase students 'interest and motivation, enable students to be actively involved in the process, and in parallel with this situation, they are effective in increasing students' success. It was emphasized that visual coding tools play an important role in the development of students' positive attitudes towards coding. Scratch and Mblock from block-based environments of Otu (2020); Using Python, one of the text-based programming environments, in his research, it was observed that block-based environments positively affect students' attitudes towards coding.

As a result of the research, it was seen that block-based coding training in Blocky environment had a positive effect on students' CT skills and attitudes towards coding education. In addition, in line with the students 'opinions, it was concluded that the education given in the blocky environment increased the students' interest and motivation towards the lesson. When the studies in the literature are examined, it has been determined that there are many national and international studies that examine the effect of block-based coding education on CT and students' attitudes towards coding education with different factors, different age groups and different learning environments. These studies also show that teaching coding is very important in terms of gaining age skills, especially CT skills. In order not to fall behind the skills required by the age, it is thought that it would be beneficial to increase the course hours in order to create the necessary environments for the ICT course and to give students enough time to produce various products with coding training.

Suggestions

- This study was conducted to investigate the effect of block-based coding education on CT skills. The effect of block-based coding education on different 21st century skills such as critical thinking and problem solving, collaborative work and creativity can be examined.
- This study was conducted with 5th grade students. The effect of block-based coding instruction on the thinking skills and academic success of students of different age groups can be examined.
- The study was conducted with 38 students in a limited period of 6 weeks. In order for us to generalize the research results more, long-term research can be done with a larger sample.
- In this study, the effect of using Blocky in block-based coding education on students' academic success was not examined. Academic success can also be taken into account in future studies on this subject.
- Coding teaching in 5th and 6th grades in primary education is given as 2 hours a week within the scope of ICT course. It is thought that by increasing the course hours, the coding process will be more efficient and students will be more involved in the learning process.

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