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Robotic Coding Education of Middle School Students Cognitive Skills Awareness and Its Effect on Responsibility for Learning: Abilix Krypton 7 Example

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SUMMARY

The aim of this study is to examine the effect of robotic coding education on cognitive skills awareness and learning responsibilities. The training prepared in this process was designed and implemented by subject experts. The training has been organized as 4 hours a week to last 4 weeks. In this study, both quantitative and qualitative research methods used as a mixed method were used as a research model. Explanatory Sequential Pattern is used. In this study, quantitative research method and "Pretest - Posttest Control Group Semi-Experimental Pattern Model" was used as the research model. As a result of the applications, a statistically significant difference was found between the values of students' metacognitive awareness and learning responsibilities before and after education ($p < 0.05$). The eta squared value was examined to determine the effect size of the robotic coding environment on the total of Academic Achievement, Metacognitive Awareness Scale for Children (MCS-C) and Responsibility for Learning Scale. It can be said that the robotic coding environment has a "large" effect size on Academic Achievement, Metacognitive Awareness for Children and Responsibilities for Learning.

Keywords: Robotic Coding, Academic Achievement, Learning Responsibility, Metacognitive.

INTRODUCTION

One of the most important skills of the 21st century has been to adapt to the digital world. In this, it is very important to follow the developments and changes in the digital world. The group that will most adapt to these changes and developments are our school-age children and university students. Technology is ubiquitous and integrated into every aspect of our lives (Eguchi, 2014). Students of our age are very intertwined with technology in every field. Therefore, it is very important to use technology correctly.

In the developing world, it is thought that young people should have thinking skills that can support their cognitive development such as problem solving, critical thinking and algorithmic thinking skills (Scot, 2018). With the increase in technological developments and people's adaptation to technology, it is predicted that individuals with programming and algorithmic thinking skills have critical thinking, problem solving and algorithmic thinking skills. It is seen that these acquisitions, such as software and robotics, are effective in gaining these thinking skills (Nam, Kim & Lee, 2010; cited in Yünkül, Durak, Çankaya & Mısırlı, 2017). In secondary school, objects were structured with the necessary robotic work as a field of knowledge and technical creativity, and modern social infrastructure development trends enriched with robotics (Ospennikovaa et al., 2015). In this structuring process, students will be able to learn from the 21st century. It has always been a matter of curiosity how he will contribute to his skills. Which skills robotics can contribute to the person is also an issue that researchers should examine.

Education theorists believe that robotic activities have enormous potential to improve classroom teaching (Benitti, 2012). To give an example, the effect of coding and robotics course on our students' educational processes, ensuring effective learning with one-to-one participation, influencing students' ability to use computers actively, improving their cognition levels, creating original projects, developing their imaginations, being responsible for their own learning, learning It helps them to improve their activity in the process. However, adding many skills to the student has increased the importance of robotic coding training (Göksoy & Yılmaz, 2018; Göncü et al., 2018).

Purpose of the Research

The aim of this research is to examine the effect of robotic coding education on metacognitive skill awareness and learning responsibilities. For this purpose, the following sub-purpose questions will be answered.

(1) Does it increase the responsibility for learning of secondary school students where robotic coding education is applied?

(2) Does it increase the metacognitive awareness of secondary school students, where robotic coding education is applied?

(3) Does robotic coding education increase the success of students in the academic achievement test?

(4) Is the robotic coding education of the students significant on the experimental and control groups?

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Importance of Research

Today's technological developments have increased the importance of computer science. The need to train qualified people with coding skills has emerged in this field. In order to meet this need in the world and in our country, education is provided from pre-school education to university level. Considering the qualified manpower that will be needed in this field in the future, it is important to provide robotic coding education to people with technological methods since secondary school and to renew the training methods according to the changing conditions of the day (Şahin, 2019).

Metacognition is a term used to observe and regulate one's own learning, problem solving, comprehension, reasoning, etc. processes (Metcalfe & Shimamura, 1996). Thus, the person displays his/her effective behavior by following his/her own cognition and structuring it in the most accurate way (Gourgey, 2002).

The responsibility of learning has an important place in the success that is desired to be achieved in education. It is known that this concept is associated with terms such as "learner control", "academic self-efficacy", "self-regulation". It is important for students to achieve success in their academic life in the responsibility of learning (Yakar, 2017). For this reason, the effect of the robotic coding training was measured by giving the Robot Coding training with the metacognitive awareness and learning responsibility scale. It is thought that the effect of Robotic Coding on metacognition and responsibility for learning is important.

Considering that the coding skill will form the basis of many professions in the future, it is of great importance to find the best method suitable for the relevant target audience in order to acquire this skill, and to make postgraduate and doctoral dissertations in this direction, as well as to make suggestions for situation analysis and improvement of the current situation with academic studies. Since the robotic coding field is a rapidly changing field, although there are previous studies in this field in the literature, studies should be repeated, and developments should be examined as it is a rapidly changing field.

METHOD

In this study, in which the effect of robotic coding education on students' academic success in Robotic Coding course, metacognitive skill awareness and responsibilities towards learning was investigated, the mixed method used for both quantitative and qualitative research was used as a research model. Exploratory Sequential Pattern is used. First, quantitative data is collected and analyzed, followed by qualitative data collection and analysis, and the analyzes are interpreted. The purpose of this method is to mix two different methods in a single research and to ensure that the analyzes focus on the problems of the research in the collected data. Thus, it is important to analyze the data as detailed as possible and directly include the statements of the working group. The purpose of applying the quantitative research method is to examine the effect of the suitability of the proposed theory on learning outcomes (Creswell & Plano-Clark, 2007; Miles & Huberman 1994; Straus & Corbin, 1998). In this study, the independent variable was determined as Robotic Coding training as Coding training. Dependent variables are academic achievement test, metacognitive skill awareness and learning responsibilities. In this study, with the quantitative research method, which we consider as a research model, "Pretest – Posttest Quasi-experimental Design Model with Control Group" was used (Campbell & Stanley, 1966). In the studies using experimental design with pretest and posttest control groups; Participants are subjected to a measurement related to the dependent variable in academic studies, both before and after the study application. Participants are divided into experimental and control groups in the research (Karasar, 1999). The groups from which the participants leave are determined randomly. In order to examine the effect of the experimental procedure according to different variables, data collection tools developed by the researchers are applied to two groups before and after the application (Büyüköztürk et al., 2012). In the qualitative dimension of the research, the answers given by the experimental group students to the semi-structured interview form applied before and after the application, which was applied for 4 weeks, were analyzed and the results were obtained from the qualitative data. Within this scope, quantitative data were collected by applying the students' academic achievement test, metacognitive skill awareness and the effect of pre-tests and pre-tests on learning responsibilities.

Table 1. Semi-Experimental Pattern Table on Research Model.

Groups	Pre-test	Method	Last test
G_D	O_1	X_{BC}	O_2
G_K	O_1	X_{GO}	$O_{2.}$

GD= Experimental group

GK= Control group

X_{BC} = Robotic Coding project method

$X_{GÖ}$ = Traditional learning method

O_1= Experimental and Control group pre-test application

O_2= Experiment and Control group final test application

Study Group

The universe of the research consists of 7th grade students who take Robotic Coding course at Keykavus Bilgehane institution of Konya Metropolitan Municipality, who are studying at various secondary schools in Konya in the 2019-2020 academic year. Within the scope of the research, the target audience was determined considering the fact that Robotic Coding training requires one-to-one communication, the length of the Robotic Coding course is long and there is a limited number of Robotic Coding materials

Table 2. Experiment and Control Group Information

Groups	N	%
Experimental Group	20	50,0
Control Group	20	50,0
Sum	40	100,0

When the table is examined, the total number of students targeted to be reached is 40, including 20 control and 20 experimental groups (Table 2).

Table 3. Participants' Gender Information

Gender	N	%
Woman	21	52,5
Male	19	47,5
Sum	40	100,0

When the table is examined, the total number of students is 40, 52.5% (N=21) of the students targeted to be female and 47.5% (N=19) male (Table 3).

Table 4. Out-of-School Interest Information of Participants

Out-of-School Interest	N	%
Computer/ Tablet	24	60,0
Sports(Football/ Basketball)	4	10,0
Book	12	30,0
Sum	40	100,0

When the table was examined, 60% (N=24) Computer/Tablet, 10% (N=4) Sports (Football/ Basketball) and 30% (N=12) stated that they were interested in the book (Table 4).

Research Instruments and Processes

In the research, academic achievement test for the course will be developed and 2 different scales will be used to determine the upper cognitive awareness scale and their responsibility for learning. At the end of the training, qualitative data collection tool was used using the interview form. The measurement tools to be used in the data collection tool can be briefly explained as follows.

Semi-Structured Interview Form

The studies in the interview form were prepared jointly by the researcher by reference. The 16 questions of the form were applied before the training and 8 questions were applied at the end of the training. The form applied before the training measures concepts and perceptions about robotics, while the form applied at the end of the training is applied to measure the student's satisfaction and end-of-class perception. 4 of the 8 questions of the form applied at the end of the training are open-ended questions. While analyzing open-ended questions, the answers given by the students were collected under certain headings.

Upper Cognitive Awareness Scale for Children

Karakelle and Sarac (2007) were in Turkish, and the scale was created by Sperling, Schraw and Dennison (1994) based on the Metacognitive Inventory (MAI) developed for adults. I used form B, an 18-point B form that covers students up to class. Marking is carried out using the likert type scale for all substances in the form (always, often, sometimes, rarely, never). The points to be obtained on the scale are obtained by collecting the item points. The scores are not calculated separately for the regulation of cognition information and cognition. The height of the upper cognitive skills is examined by considering the height of the total score. The highest score of the scale is 90 and the lowest score is 18. The scale consists of 18 substances. The reliability coefficient (Cronbach alpha) of its scale is .80. Permission has been obtained for the use of the scale.

Scale of Responsibility for Learning

Scale was developed by Yakar and Saracaloglu (2017). Analysis studies were carried out to examine the psychometric properties of the scale. These are the ones that are going to internal consistency is substance and factor analysis. The number of substances of the scale is 35. The lowest score from the scale is 35 points and the highest score is 175 points. In using the scale in studies, the scores of the participants from the entire scale have meaning. For example, when a participant scores 80 points across the entire scale, it is "moderate"; when another participant scores 170, it can be interpreted as having a "very high level" of learning responsibility. The reliability coefficient (Cronbach alpha) of its scale is .936. Permission has been obtained for the use of the scale.

Academic Achievement Test

The reliability coefficient of a multiple-choice test (academic success test) must be determined. For this purpose, the formulas KR-20 and KR-21 are generally used (Trust, 1990). When using this method, "1" is created by giving "1" if there is an expected property in the responses from the items to create data sets in the measurement tool during the application process, and "0" if there is no expected feature. The characteristics determined for the determination of the internal reliability coefficient of the tests are taken into account and the formula is used, whichever formulas are more suitable than KR-20 or KR-21 (Ercan and Kan, 2004). The token table for the academic achievement test used in the study is specified in Table 5.

Table 5. Token Table for the Preparation of the Academic Achievement Test

Questions	Benefits
2,3,7	Recognizes the concept of coding and understands its importance. It can use the given operations in consecutive digits.
4,5,6,7,18	Knows and draws flowchart concepts.
14,15,17	He knows the algorithm definition. Recognizes the given commands and learns to guide algorithmic flow. Develops algorithms using loop and condition concepts. Understands transaction operators
19,13	Recognizes the Abilix application interface. Abilix recognizes robot programming.
9,14,16,10	Creates a motion and control flowchart. Develops the application with the motion module.
1,20,10	Understands the structure of code blocks and, or conditions.
8,11,12	Recognizes sensors. Develops applications using sensors. Design's robots using sensors. Recognizes the distance sensor and its properties. Programs designs that achieve specific goals.

The difficulty index of the multiple-choice test academic achievement test was found to be =.813.

Data Analysis

The demographic information of the participants is explained by the description statistics. These statistics are frequency, percentage, arithmetic mean and standard deviation. Using the SPSS 22 (Statistical Package for Social Sciences) program, numerical data collected before and after the experimental procedure were analyzed in the quantitative dimension of the study. T-test was used for related samples in the study. In this analysis, the aim is to compare the preliminary test applied before the research of the students who went through the experimental process with the data collected from the last test applied after the research. In unrelated samples, t-test is used to test whether the difference between two unrelated sample averages makes sense (Büyüköztürk, 2011).

Analysis of Pre-Application Data

The results of the comparison (independent t-test for unrelated samples) of data obtained from academic success, responsibility for learning and upper cognitive awareness for children (PPI)scales applied before application (preliminary tests) to the experimental and control group are given in Table 6.

Table 6. Findings on The Equivalence of Groups in Terms of Academic Success

	Groups	N	$\overline{X}$	Ss	Sd	t	p
Pre-test	Experimental group	20	9,40	3,05	38	1,723	,093*
	Control group	20	8,00	1,97			

*p<0.05

After the experimental and control groups were determined before the application, (experimental group pre-test average $\overline{X}$ =9,40; control group pre-test average $\overline{X}$ =8,00) *p<.05 for the level of significance .05<p because it is not meaningful.

Table 7. Findings on equivalence of groups in terms of Scale of Responsibility for Learning

	Groups	N	$\overline{X}$	Ss	Sd	t	p
Pre-test	Experimental group	20	140,15	19,79	38	-,256	,799*
	Control group	20	141,55	14,32			

*p<0.05

After the experimental and control groups were determined before the application, (experimental group pre-test average $\overline{X}$ =140,15; control group pre-test average $\overline{X}$ =141,55) *p<.05 for the level of significance .05<p because it is not meaningful.

Table 8. Findings on Equivalence of The Upper Cognitive Awareness Scale for Children Between Groups

	Groups	N	$\overline{X}$	Ss	Sd	t	p
Pre-test	Experimental group	20	71,25	10,55	38	-,073	,942*
	Control group	20	71,50	10,95			

*p<0.05

After the experimental and control groups were determined before the application, (experimental group pre-test average $\overline{X}$ =71,25; control group pre-test average $\overline{X}$ =71,50) *p<.05 for the level of significance .05<p because it is not meaningful.

RESULTS

In this section, the questions of the research, the statistical results of the collected data and the conclusions reached are detailed in the comments of the research questions. Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .906 in the reliability test with data collected from the study group after the application for the Responsibility for Learning Scale. After the application of the Upper Cognitive Awareness Scale for Children (BFÖ-Ç), the internal reliability coefficient was calculated in the reliability test with the information collected from the study group. Cronbach's Alpha reliability coefficient was found to be .908.

Analysis of Quantitative Data

Experimental group Pretest – Final test comparison (paired t test)

As a result of the application, the results of the preliminary tests and comparisons of the final tests to determine the status of the experimental group students are given in Table 9.

Table 9. Experimental Group Pretest-Final Test Comparison Results for Academic Achievement Test Total

	Test	N	$\overline{X}$	Ss	Sd	t	p
Experiment Group	Pre-test	20	9,40	3,050	19	13,781	.000
	Last test	20	13,80	3,473			

*P<0.05

The experimental group was statistically different for the *p<.05 signivity level (p<0.05) between the pretest and final test scores (pre-test average $\overline{X}$ =9.40; final test average $\overline{X}$ =13.80). As a result of the Robotic Coding application attended by the experimental group students, it was determined that they increased the success of the academic achievement test (Table 9).

Experimental group Pretest – Final test comparison (paired t test)

Comparisons of preliminary and final tests were made to determine the status of the experimental group students as a result of the application. The result is given in Table 10.

Table 10. Test Group Preliminary-Final Test Comparison Results for Learning Responsibility Scale Total

	Test	N	$\overline{X}$	Ss	Sd	t	p
Experiment Group	Pre-test	20	140,15	19,792	19	31,668	.000
	Last test	20	154,20	15,237			

*P<0.05

In the application, it was found that the experimental group was statistically different in terms of pre-test-final test scores (preliminary test average $\overline{X}$ =140.15; final test average $\overline{X}$ =154<.05) *p<0.05). As a result of the Robotic Coding application attended by the students of the experimental group, it was determined that they increased the Responsibility for Learning Scale (Table 10).

Experimental Group Pretest – Final Test Comparison (Paired T Test)

Pre-test and final tests were compared to determine the status of the experimental group students as a result of the application. This comparison result is given in Table 11.

Table 11. Upper Cognitive Awareness Scale for Children Experimental Group for Total Preliminary Test-Final Test Comparison Results

	Test	N	$\overline{X}$	Ss	Sd	t	p
Experiment Group	Pre-test	20	71,25	10,557	19	30,181	.000
	Last test	20	83,20	9,435			

*P<0.05

In the application, it was found that the experimental group was statistically different in terms of pre-test-final test scores (preliminary test average $\overline{X}$ =71.25; final test average $\overline{X}$ =83.20) *p<.05 significance level (p<0.05). As a result of the Robotic Coding Course attended by the experimental group students, it was determined that they increased their responses to the Upper Cognitive Awareness Scale for Children (Table 11).

Control group Pretest – Final test comparison (paired t test)

Pre-test and final tests were compared to reveal the status of the control group students as a result of the application. The result is given in Table 12.

Table 12. Academic Achievement Test Control Group Preliminary-Final Test Comparison Results for Total

	Test	N	$\overline{X}$	Ss	Sd	t	p
Control Group	Pre-test	20	7,00	1,974	19	18,129	,000
	Last test	20	8,00	1,974			

*p<0.05

In the application, it was found that the control group was statistically different between the pre-test-final test scores (pre-test average $\overline{X}$ =7.00; final test average $\overline{X}$ =8.00) *p<.05 in terms of significance level (p<0.05). It was observed that there was a significant difference as a result of the traditional teaching attended by the control group students (Table 12).

Control Group Pretest – Final Test Comparison (Paired T Test)

Pre-test and final tests were compared to reveal the status of the control group students as a result of the application. The result is given in Table 13.

Table 13. Control Group Pre-Test-Final Test Comparison Results for Learning Responsibility Scale Total

	Test	N	$\overline{X}$	Ss	Sd	t	p
Control Group	Pre-test	20	141,55	14,321	19	44,202	.000
	Last test	20	143,20	17,817			

*p<0.05

In practice, it was found that the control group was statistically different between preliminary test-final test scores (preliminary test average $\overline{X}$ =141.55; final test average $\overline{X}$ =143.20) *p<.05 in terms of significance level (p<0.05). It was observed that there was a significant difference as a result of the traditional teaching attended by the control group students (Table 13).

Control group Pretest – Final test comparison (paired t test)

Pre-test and final tests were compared to reveal the status of the control group students as a result of the application. The result is given in Table 14.

Table 14. Control Group Pre-Test-Final Test Comparison Results for Children's Upper Cognitive Awareness Scale Scale Total

	Test	N	$\overline{X}$	Ss	Sd	t	p
Control Group	Pre-test	20	71,50	10,957	19	29,183	,000
	Last test	20	76,50	11,335			

*p<0.05

In practice, the control group was found to be statistically different between pre-test-final test scores (preliminary test average $\overline{X}$ =71.50; final test average $\overline{X}$ =76.50) *p<.05 in terms of significance level (p<0.05). It was observed that there was a significant difference as a result of the traditional teaching attended by the control group students (Table 14).

Test-Control Group Final Tests Comparison (Independent T Test)

The result of comparing the academic achievement tests of students (experimental group) who use robotic coding course environment and students who do not use it is given in Table 15.

Table 15. Academic Achievement Test Intergroup (Experiment- Control Group) Final Test Comparison (T - Test) Results for Total

Groups		N	$\overline{X}$	S	Sd	t	p
Last test	Experimental group	20	13,80	3,473	38	7,613	.000*
	Control group	20	7,00	1,974			

*P<0.05

*p<.05 significance level was determined in the final tests after the application to the experimental and control group. This level makes sense because our test result is .00 < .05. In the latest tests (test group final test average $\overline{X}$ =13.80; control group final test average $\overline{X}$ =7.00), the final test scores of the test group were higher than the final test scores of the control group (Table 15). The result is that the application applied is in the best interest of the experimental group. In addition, the eta square value was looked at to determine the magnitude of the impact of the robotic coding environment on **Academic Achievement.** The effect magnitude values are calculated as η2= .119. In this case, considering the impact magnitude value (η2= 0.119), it can be concluded that the robotic coding environment has a "wide" impact on **Academic Achievement.**

Test-Control Group Final Tests Comparison (Independent T Test)

The result of comparing the "Responsibility Scale Totals for Learning" of students (experimental group) who use robotic coding environment and students who do not use it (control group) is given in Table 16.

Table 16. Intergroup (Experimental- Control Group) Final Test Comparison (T-Test) Results for Learning Responsibility Scale Total

Groups		N	$\overline{X}$	S	Sd	t	p
Last test	Experimental group	20	154,20	15,237	38	2,098	.043*
	Control group	20	143,20	17,817			

*P<0.05

It makes sense because the < .00 is .05 for the *p<.05 significance level in the final post-application tests performed on the experiment and control group. In the latest tests (test group final test average $\overline{X}$ =154.20; control group final test average $\overline{X}$ =143.20), the final test scores of the test group were higher than the final test scores of the control group (Table 16). The result indicates that the application is in the best interest of the experimental group. In addition, the eta square value was examined to determine the magnitude of the impact of the Robotic Coding environment on the Total Responsibility for Learning Scale. The effect magnitude values are calculated as $\eta 2=.117$. In this case, considering the impact magnitude value ($\eta 2= 0.117$), it can be said that the Robotic Coding environment has a "wide" impact on the Total of Responsibility for Learning Scale.

Test-control group final tests comparison (independent t test)

The result of the students (experimental group) using the Robotic Coding environment and the students who did not use it (control group) compared to the "Top Cognitive Awareness Scale for Children total" was given in Table 17.

Table 17. Upper Cognitive Awareness Scale for Children Intergroup (Experiment - Control Group) Final Test Comparison (T - Test) Results

Groups		N	$\overline{X}$	S	Sd	t	p
Last test	Experimental group	20	83,20	9,435	38	2,032	.048*
	Control group	20	76,50	11,335			

*P<0.05

It makes sense because the *p<.05 significance level is .00 <.05 in the final post-application tests performed on the experiment and control group. In the latest tests (test group final test average $\overline{X}$ =83.20; control group final test average $\overline{X}$ =76.50), the final test scores of the test group were higher than the final test scores of the control group (Table 17). This result indicates that the application is for the benefit of the experimental group. In addition, the eta square value was examined to determine the effect magnitude of the Robotic Coding environment on the total impact on the Upper Cognitive Awareness Scale (BFÖ-Ç) for Children. The effect magnitude values are calculated as $\eta 2= .124$. In this case, considering the impact magnitude value ($\eta 2= 0.124$), it can be said that the robotic coding environment has a "wide" effect size on the total on the Upper Cognitive Awareness Scale for Children (BFÖ-Ç).

Analysis of Qualitative Data

The results of the survey, which was conducted to measure the preliminary knowledge and perceptions of the participants before the application, are given in Table 18.

Table 18. Experiment-Control Group Coding Concepts-Perception Information

		Experimental Group		Control Group	
		N	%	N	%
Sensor	Yes	17	85,0	13	65,0
	No	3	15,0	7	35,0
Servo Motor	Yes	7	35,0	3	15,0
	No	13	65,0	17	85,0
Loop	Yes	13	65,0	12	60,0
	No	7	35,0	8	40,0
Battery	Yes	19	95,0	17	85,0
	No	1	5,0	3	15,0
Algorithm	Yes	19	95,0	20	100,0
	No	1	5,0		
Decision Structure	Yes	8	40,0	6	30,0
	No	12	60,0	14	70,0
	Yes	10	50,0	11	55,0

Have you ever coded with a computer or tablet?	No	10	50,0	9	45,0
Do you know anything about robotics?	Yes	12	60,0	10	50,0
	No	8	40,0	10	50,0
Do you think some of the lessons at school can be learned using robots?	Yes	15	75,0	13	65,0
	No	5	25,0	7	35,0
Have you ever thought about inventing something new?	Yes	17	85,0	17	85,0
	No	3	15,0	3	15,0
Have you ever thought about inventing something new?	Yes	16	80,0	17	85,0
	No	4	20,0	3	15,0
You will perform various activities using robots. How would you like to do these activities?	Alone	2	10,0	4	20,0
	With a Friend	12	60,0	10	50,0
	With Group	6	30,0	6	30,0
What kind of events Do you like it?	Artistic	5	25,0	3	15,0
	Scientific	9	45,0	15	75,0
	Sporty	6	30,0	2	20,0
That you can design suitable robots in your activities Do you think about it?	Yes	14	70,0	7	35,0
	No	1	5,0	2	10,0
	I'm undecided.	5	25,0	11	55,0
What do you think of the programming of robots?	It's so easy	1	5,0	1	5,0
	Easy	8	40,0	3	15,0
	I'm undecided.	9	45,0	11	55,0
	Difficult	1	5,0	4	20,0
	It's very difficult	1	5,0	1	5,0
How many hours do you spend on a computer or tablet in your daily life?	0-1 Hour	8	40,0	10	50,0
	2-3 Hours	6	30,0	4	20,0
	4- 5 Hours	5	25,0	4	20,0
	6-8 Hours	1	5,0	1	5,0

According to the information provided in Table 18, it was observed that the people in the experimental and control group who created the sample knew the concepts such as sensors, algorithms, batteries, motors, which are general robotic terms, before the training, but a total of 15 students from the experiment and control group did not know the concept of cycle, and a total of 26 students did not know the concept of decision structure.

In practice, it was observed that 21 of the individuals in the sample had previously coded and 19 did not.

In practice, it was observed that 10 of the individuals in the experimental group, 11 of the people in the control group had knowledge about robotics, and 10 of the people in the experimental group and 9 of the people in the experimental group did not have any knowledge of robotic coding.

It was observed that 15 of the people in the experimental group who created the sample, 13 of the people in the control group, thought that they could do the lessons in their schools using robotics, and 5 of the people in the experimental group and 7 of the people in the experimental group thought they could not do their lessons at school using robotics.

It was observed that 17 of the people in the sample-forming experimental group, 17 of the people in the control group had previously considered inventing something, and 3 of the people in the experimental group, 3 of the people in the control group, had not previously considered inventing anything.

2 of the people in the experimental group who created the sample and 4 of the people in the control group wanted to do their robot activities alone; 12 of the people in the experimental group, 10 of the people in the control group want to do it with a friend; It was observed that 6 of the people in the experimental group and 6 of the people in the control group wanted to do it together with a group.

It was observed that 14 of the people in the sample group and 7 of the people in the control group were determined to design the appropriate robot in the activities to be performed, a total of 3 people from both groups could not design, and 5 of the people in the experimental group and 11 of the people in the control group were undecided. It has been observed that most of the people who make up the sample are undecided about programming robots.

It was observed that 5 of the people in the experimental group, 3 of the people in the control group were artistic, 9 of the people in the control group, 11 of the people in the control group and 6 of the people in the experimental group, and 2 of the people in the control group liked sporting activities. In Şahin's (2019) study, the type of activity that students enjoyed with academic success found a significant difference between test scores. In the comparison, it was observed that the academic achievement test scores were significantly higher than those of the students who liked the kinds of activities related to art and who liked their scientific and sporting activities.

It was determined that the majority of the people in the sample spent between 0-3 hours of their daily life using computers or tablets.

Table 19. Robotic Coding Training Satisfaction Form

What do you think of the use of robots in your lessons?	I'd appreciate it.	9	45,0	9	45,0
	I'd appreciate it.	5	25,0	5	25,0
	I'd appreciate it.	3	15,0	5	25,0
	I'm not happy	2	10,0	1	5,0
	I'm not happy	1	5,0	9	45,0
Would you suggest applying robotics in other classrooms and classes?	Yes	17	85,0	12	60,0
	No	3	15,0	8	40,0
Compared to what you thought before you did robotics projects, how interested are you in information technology right now?	Yes	8	40,0	8	40,0
	No	12	60,0	9	45,0
When you compare it to your thoughts before you did robotic applications, how interested are you in robotics right now?	It's more like.	11	55,0	8	40,0
	Same	7	35,0	9	45,0
	Less	2	10,0	3	15,0
What's the first device you can think of when you think of coding? *	Brain, Cable, Robot, Sensor	8	40,0	8	40,0
	Tablet, Phone, Computer	12	60,0	12	60,0
What profession do you want to choose in the future? *	Field of Informatics (Engineer, Teacher)	8	25,0	3	15,0
	Doctor	3	30,0	7	35,0
	Teacher	7	35,0	3	15,0
	Policeman	1	5,0	2	10,0
	Other	1	5,0	5	25,0
Why do you want to learn coding? *	Curiosity	3	15,0	1	5,0

	Affinity	5	25,0	4	20,0
	Self-improvement	9	45,0	12	60,0
	Other	3	15,0	3	15,0
What do you think about the use of robotic coding in lessons? *	That'd be nice.	15	75,0	14	70,0
	I do not know	4	20,0	3	15,0
	Other	1	5,0	3	15,0
Sum		20	100	20	100

(* The questions specified by are open-ended questions.)

At the end of the training given within the scope of the study, participants were given a satisfaction questionnaire to measure their attitudes towards robotics education. According to the data that emerged from robotic satisfaction.

9 of the people in the experimental group who sampled the use of robots in your lessons and 9 of the people in the control group were very satisfied; 5 of the people in the experimental group and 5 of the people in the control group were satisfied; 3 of the people in the experimental group and 5 of the people in the control group were somewhat satisfied; 2 of the people in the experimental group and 1 in the control group were not satisfied; It was observed that 1 of the people in the experimental group and 9 of the people in the control group were not satisfied at all.

It was observed that 17 of the people in the sample-forming experimental group, 12 of the people in the control group, proposed to use robotic applications in other classes and courses, 3 of the people in the experimental group and 8 of the people in the control group did not recommend using robotic applications in other classes and courses.

When you compare it to your thoughts before you do robotics projects, it was observed that 8 of the people in the experimental group who are currently sampling the question of how interested you are in the information technology course, 8 of the people in the control group are the same, and 11 of the people in the experimental group and 9 of the people in the control group are more interested.

The answers to open-ended questions are.

It was observed that 8 of the people who answered "brain, cable, robot, sensor" when the answers to the question "What is the first device that comes to mind when you think of coding" in the experimental group were 12, and when the answers given in the control group were under certain headings, 8 of the people who answered "brain, cable, robot, sensor" answered "tablet, phone, computer".

It was observed that 8 of the people who answered, "Informatics Field (engineer, teacher)" when the answers to the question "What is the profession you want to choose in the future?" were 3 of the people who answered "doctor", 7 of the people who answered "Teacher", 1 of the people who answered "police" and 1 among other professional groups. It was observed that when the answers to the question "What is the profession you want to choose in the future?" in the control group were given certain headings, 3 of the people who answered "It Inerary Area (engineer, teacher)", 7 of the people who answered "doctor", 3 of the people who answered "Teacher", 2 of the people who answered "police" and 5 people who answered from other professional groups.

It was observed that the people who answered "curiosity" when the answers to the question "Why Do You Want to Learn Coding?" in the experimental group were 3, the people who answered "interest" were 5, the people who answered "To improve myself" were 9 and the number of people who answered from other professional groups was 3. It was observed that the people who answered "curiosity" were 1 person, the people who answered "interest" were 4, the people who answered, "To improve myself" were 12 and the number of people who answered from other professional groups was 3 when the answers to the question "Why Do You Want to Learn Coding?" were given in the control group.

It was observed that the people who answered, “it would be good" when the answers to the question "Your opinion about Robotic Coding in the courses?" were 15, the people who answered "I don't know" were 4 and the number of people who answered from other professional groups was 1 person. It was concluded that the people who answered, "it would be good" when the answers to the question "Your opinion about Robotic Coding in lessons?" in the control group were 14, the people who answered "I don't know" were 3 and the number of people who answered from other professional groups was 3.

DISCUSSION AND CONCLUSION

In this section, the results are discussed taking into account the findings obtained at the end of the research. The results were obtained according to the information obtained when the demographic information forms applied before the training of 40 samplings were examined within the scope of the study.

•The answers of the sample creators to the question "Which one do you spend the most time with outside of school?" were concluded that 24 people spent time on computers and 4 people spent time with tablets and 12 people spent time with books. Sahin (2019) research concluded that students spend their time outside of school with technological instruments such as tablets and computers. It was demonstrated that robotic concepts existed in the minds of the students before the education given within the framework of this study. In his study, he attributed the knowledge of the concepts of students to the popularity of robotics education today.

•2 of the people in the experimental group who created the sample and 4 of the people in the control group wanted to do their robot activities alone; 12 of the people in the experimental group, 10 of the people in the control group want to do it with a friend; It was observed that 6 of the people in the experimental group and 6 of the people in the control group wanted to do it together with a group.

•It was observed that 5 of the people in the experimental group, 3 of the people in the control group were artistic, 9 of the people in the control group, 11 of the people in the control group and 6 of the people in the experimental group, and 2 of the people in the control group liked sporting activities. In Sahin's study, he looked at a meaningful difference between the type of activity students liked and the academic achievement test. It was determined that there was a significant difference. Various comparisons have been made. These are the ones that are going to academic achievement test scores of students who enjoy artistic activities are found to differ significantly higher than academic achievement test scores of students who enjoy scientific and sporting activities.

At the end of the training given within the scope of the study, a few questions were applied for the students to be satisfied about robotics education. According to the information obtained from the satisfaction of robotics education.

•9 of the people in the experimental group who sampled the use of robots in your lessons and 9 of the people in the control group were very satisfied; 5 of the people in the experimental group and 5 of the people in the control group were satisfied; 3 of the people in the experimental group and 5 of the people in the control group were somewhat satisfied; 2 of the people in the experimental group and 1 in the control group were not satisfied; It was observed that 1 of the people in the experimental group and 9 of the people in the control group were not satisfied at all.

•It was observed that 17 of the people in the sample-forming experimental group, 12 of the people in the control group, proposed to use robotic applications in other classes and courses, 3 of the people in the experimental group and 8 of the people in the control group did not recommend using robotic applications in other classes and courses. Karademir and his colleagues (2018) said that using robots with music lessons would increase interest in that course and that gains could be learned in a more fun way.

•When you compare your ideas before studying robotics, it was observed that 8 of the people in the experimental group, 8 of the people in the control group were the same, and 11 of the people in the control group were more interested in the question of how interested you are in the information technology course. Costa and his colleagues (2008) observed that students were very keen on robotic coding activities.

The answers to open-ended questions are.

•It was observed that the people who answered "curiosity" when the answers to the question "Why Do You Want to Learn Coding?" in the experimental group were 3, the people who answered "interest" were 5, the people who answered "To improve myself" were 9 and the number of people who answered from other professional groups was 3. It was observed that the people who answered "curiosity" were 1 person, the people who answered "interest" were 4, the people who answered, "To improve myself" were 12 and the number of people who answered from other professional groups was 3 when the answers to the question "Why Do You Want to Learn Coding?" were given in the control group. The answers given and the reviews in the field article support each other. According to the research conducted by Akpınar and Altun (2014), individuals gain many qualifications together at the same time through coding training. According to the research, it has been shown that there is a significant difference between the students who are studying coding at a young age compared to the students who do not receive coding training.

•It was observed that the people who answered, "it would be good" when the answers to the question "Your opinion about Robotic Coding in the courses?" were 15, the people who answered "I don't know" were 4 and the number of people who answered from other professional groups was 1 person. It was concluded that the people who answered, "it would be good" when the answers to the question "Your opinion about Robotic Coding in lessons?" in the control group were 14, the people who answered "I don't know" were 3 and the number of people who answered from other professional groups was 3. In a 2009 study, Nishida and his colleagues found that studies in a non-computer environment improved students' motivation, creativity and thinking abilities. It was concluded that the students who participated in the studies did not have difficulty in this process because they formed the basis for an effective, level-appropriate educational study. Similar research results are found in field writings like this one. In its study of rich (2016) gifted BILSEM students, it was found that 62% of students had the idea that robots were easy to use and code in the activities they would create and thought they could create robots in the activities they would create. Kıran's (2018) worked with gifted students and gave them project-based basic robotics training for a certain period of time. At the end of the process, it was observed that the students tried to solve the problems of daily life by designing robots in their daily lives. Göksoy and Yilmaz (2018) researched the conclusion that all children believe that the knowledge they have learned in robotics and coding lessons in their daily lives in the future will be useful to them.

Based on the answers to open-ended questions, it was determined that the majority of students came to robotic coding class because they were interested in improving themselves. Likewise, in a study conducted by Baz (2018), he reported that coding applications created for students in younger age groups are aimed at increasing motivation in students. Looking at the answers given, it was determined that one of the first devices that comes to mind when it comes to coding of students is computer and tablet. Looking at the answers given, the majority of the students developed a positive attitude by concluding that the majority of the students would be good in the answers given to the students' thoughts about robotic coding in the courses. Patan (2016) study shows that the attitudes of the students in kindergarten are positive. SPSS 22 (Statistical Package for Social Sciences) program was used to analyze the quantitative results of the study. T-test was used for the associated samples in the comparison of the data obtained from the final test with the preliminary test applied to the participants during the experimental process. P=0.05 was analyzed at the level of signation. According to this analysis.

As a result of the Robotic Coding application attended by the experimental group students, it was determined that they increased the success of the academic achievement test (Table 9). The experimental group was statistically different for the *p<.05 signivity level (p<0.05) between the pretest and final test scores (pre-test average =9.40; final test average =13.80). In his study titled "Views on the Use of Robotic Systems in Interdisciplinary Education & Training of Elementary, Middle and High School Students", Zengin (2016) investigated the change of students' views on the use of robot systems in education according to certain variables. In the study, 100 people were selected and the pre-test - final test control group pattern of the semi-experimental method was used. At the end of the study, it was determined that the students had a positive opinion about the use of robotic technologies in the courses. According to the study conducted by Özdoğru (2013), the academic achievement levels of the students in the training given with the Lego Mindstorms NXT 2.0 robotic training set were found to be a significant difference before and after the training.

As a result of the Robotic Coding application attended by the students of the experimental group, it was determined that they increased the Responsibility for Learning Scale (Table 10). Among the test group pre-test-final test scores (preliminary test average =140.15; final test average =154.20), it was statistically different for the *p<.05 signability level (p<0.05). In research, It has been observed that the age of the individual is in the opinion of acting independently of the environment and making individual decisions, and the more experience the individual has on a subject, the greater the thought of sharing the responsibility given with the environment. In response to this data, it was determined that this idea was initially taken over by itself (Illeris, 2003; Sierra, 2009). In the research conducted by Altun (2018), we can say that the coding and algorithm education given to preschoolers of children in the 5-year-old group positively affects the problem-solving skills of the education given because there is a significant difference in the problem-solving skills of the students in the foreground and final test scores.

It was determined that the students who were trained spent their time outside of school with technological tools such as tablets and computers, and they had knowledge about robotic concepts before the training. The same conclusion was reached in the study of Şahin (2019). Today, robotics education is popular and has an effect.

As a result of the Robotic Coding Course attended by the experimental group students, it was determined that they increased their responses to the Upper Cognitive Awareness Scale for Children (Table 11). The experimental group was statistically different for *p<.05 signacy levels (p<0.05) between pre-test-final test scores (preliminary test average =71.25; final test average =83.20). These results are similar to previous studies. Clements and Gullo (1984) studied the high-level thinking abilities of participants who took programming courses at age 7. It was determined that the students who took programming courses had higher high-level thinking skills than the students who did not take this course. A few of these skills include creative thinking, reflective thinking. In a study conducted by Atmatzidou & His colleagues (2018), educational robots observed that their activities, i.e. following specific guidance and responding in writing, provide evidence that students have improved their skills to a statistically significant degree, and they argue that Educational Robots can be a tool for improving upper cognitive and problem solving skills in students in elementary and high school grades.

After the application, the level of signation of the tests performed on the control and experimental groups is interpreted taking into account *p<.05. As a result, the latest tests on the experiment and control group are .00 <

.05. In the last tests applied (test group final test average =13.80; control group final test average =7.00), the final test scores of the test group were higher than the final test scores of the control group (Table 15). This result indicates that the application performed is in favor of the experimental group. In addition, the eta square value of the robotic coding environment was examined to determine the magnitude of the impact on Academic Achievement. The effect magnitude values are calculated as $\eta 2= .119$. In this case, considering the impact magnitude value ($\eta 2= 0.119$), it can be said that the robotic coding environment has a "wide" impact on Academic Achievement. In one study, a significant increase was observed in the coding education studies given to children and the statistical data obtained before and after the education. It turned out that there was a difference between the situations at the beginning of the education process where the students were tested for skills and the gains achieved at the end of the process. These results show us that this training is effective at this age group level (Tagci, 2019).

After the application, the level of signation of the tests performed on the control and experimental groups is interpreted taking into account *$p<.05$. As a result, the latest tests on the experiment and control group are $.00 < .05$. In the last tests applied (test group final test average =154.20; control group final test average =143.20), the final test scores of the test group were higher than the final test scores of the control group (Table 16). Thus, it is observed that the application is for the benefit of the experimental group. In addition, the eta square value of the Robotic Coding environment was examined to determine the impact magnitude of the students' Responsibility for Learning Scale on the total. The effect magnitude values are calculated as $\eta 2= .117$. In this case, considering the impact magnitude value ($\eta 2= 0.117$), it can be said that the Robotic Coding environment has a "wide" impact on the Total of Responsibility for Learning Scale. In Cortina (2015) study, the applications made by the students starting from the computerized environment to the computerized environment were evaluated as a whole. In this study, it is seen that the participation of students in the application process contributes to the high level of thinking skills in cooperation. It has been demonstrated that the students participated willingly in all of the applications and successfully achieved the desired result in the group studies.

After the application, the level of signation of the tests performed on the control and experimental groups is interpreted taking into account *$p<.05$. The resulting analysis is significant because the level of signation is $.00 <.05$. In the last tests applied (test group final test average =83.20; control group final test average =76.50), the scores of the experimental group were higher than the scores of the control group (Table 17). Thus, it is seen that the application benefits the experimental group. In addition, the eta square value was examined to determine the effect magnitude of the Robotic Coding environment on the total impact on the Upper Cognitive Awareness Scale (BFÖ-Ç) for Children. The effect magnitude values are calculated as $\eta 2= .124$. In this case, considering the impact magnitude value ($\eta 2= 0.124$), it can be said that the robotic coding environment has a "wide" effect size on the total on the Upper Cognitive Awareness Scale for Children (BFÖ-Ç). Similar results were obtained in their studies in Çankaya, Yünkül and Durak (2017). In their study, the opinions of middle school students as a result of programming education were included. It has been observed that education shows positive results. As a result of the data obtained, they predicted that students with high creative thinking skills would be successful in programming education.

When we looked at the studies in the field article, it was determined that there are many international studies related to robotics education. In the rapidly developing world, developments and changes should be followed. Research and data obtained show that in order to use robotic coding training kits in information technologies and software courses, appropriate environments must be created primarily in schools and these robotic coding training sets should be found in schools. If students spend too much time with these training sets, we can predict that their minds and the projects they will produce will increase. If enough time and opportunity are given, the level of knowledge of each student will increase with these tools. It is thought that this time in schools can be provided with information technology course hours and supplementary courses.

SUGGESTIONS

- In the robotic coding training given to 7th grade students who continue their education in secondary school, it is ensured that the younger age groups where they have an impact on their upper cognition skills develop multiple areas of intelligence and the use of algorithms in their daily lives is widened. Thus, learning responsibilities can be gained at an early age.
- Internationally adopted Robotic Coding training should be shown at all levels in Turkey. The material used in this study is only one of the types of training robots. On the prediction of schools and educators, choices can be made and materials to be applied for the benefit of the student can be selected.
- Considering that the Abilix platform will be used one-on-one in the courses together with the training program and application part, theoretical information can be increased on the platform or links can be added to those who need it.

- With the training given, upper cognitive thinking skills are measured and the effect of algorithmic thinking, computational thinking, critical thinking and creative thinking, which are 21st century skills, can be observed.
- The effects can be observed by applying the training in other courses.

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