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The Effect of Coding Education Designed with Different Visual Programs On Academic Success and Attitudes and Self-Efficiencies of Secondary School Students

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ABSTRACT

This research was conducted in order to measure students' attitudes towards computer and software course while giving coding education to students, to determine students' self-efficacy perceptions towards computer and software course, to measure students' attitudes towards coding education supported by educational games, and to measure students' academic success. and observing differences in educational outcomes resulting from these measures performed. Quantitative research methods were used in this study, which examines the effects of coding education designed with different visual programs on the academic achievement, attitudes and self-efficacy of secondary school students. The applications were made for 10 weeks in accordance with the lesson plan period in the curriculum. The data obtained as a result of the training, which lasted for 10 weeks in total. According to the findings obtained at the end of the research, it was seen that the application of the Scratch program in coding education made a significant difference on the programming skills of the students and contributed to the coding education. It can be said that academic achievement has a "large" effect size on self-efficacy perceptions in computer-assisted education, attitudes towards computer-assisted education and educational computer-assisted coding education.

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INTRODUCTION

Today is called the age of information and technology, and we live in the age of information and technology. In the period we live in, students are expected to be able to access existing information and solve problems with scientific process skills rather than memorizing information. As a usual return of the age, technology is present in every aspect of our daily life (Geçer ve Funda, 2010; Somyürek, 2014). Technology is used in many fields such as health, engineering, banking, security and as a result, the use of technology in the field of education has become a necessity rather than a privilege (Geçer & Funda, 2010; Somyürek, 2014). Due to such rapid developments in technology, innovations and education follow each other synchronously (Batdal, 2005). Developing and advancing technology in all fields has also been actively used in the education and training process (Baş, 2011; Tsai & Tsai, 2003). The concept of 21st century skills, which has recently entered our lives, prepares our children for the future world, and at the same time, it is studied on which skills individuals should be equipped with (Roy-Singh, 1991). Due to the changes in education, it is expected that they produce information instead of consuming it in the century we live in. The individual desired by the 21st century and our age is not the one who accepts and memorizes the data as it is, waits to be directed and managed; They are individuals who interpret, make sense of and actively participate in the transferred information. (Yildirim & Simsek, 2008). In order for students to be given these skills, these skills must be included in the education systems. In particular, the integration of these skills with technology has revealed the idea of computational thinking and countries have started to integrate the STEM education model within their education systems (Demir & Seferoğlu, 2017). The acronym STEM is formed by combining the initials of the words Science, Technology, Engineering and Mathematics. STEM education ensures that the subjects of science and mathematics lessons can be taught practically with a holistic approach (Kırkıç & Aydın, 2018). STEM education is an education method that provides an integrated connection with daily life and these disciplines (Yıldırım & Selvi, 2017). With the increase in the application of STEM education, other innovative approach models have started to be applied in education. One of the trainings applied as one of the innovative approach methods today is coding training. In our age, developed and developing countries are working on integrating coding education into their existing education systems so that students can gain coding skills. Coding education has become very important for digital literacy skills, which is one of the 21st century skills, in order to raise people with the necessary skills of our time and future. The importance of coding education has increased with the rapid impact of technology on our daily lives and the inclusion of advancing technologies in the educational lives of both students and teachers. As a result, coding education has become widespread in schools. It is gradually included in the curriculum of information technologies and software in secondary schools (Ünsal, 2019). As a result of the researches, it was determined that problem solving skills are among the areas where primary and secondary school students are the most unsuccessful. The difficulty that students face in learning programming is mostly the lack of problem solving skills (Gomes & Mendes, 2007). The purpose of the Scratch program is to improve the use of technology in children and youth. The Scratch program is recommended by experts as the first language for children and young people to learn programming (Atun & Usta, 2019; Malan & Leitner, 2007). In Turkey, the Information Technologies and Software course is taught as a compulsory course at the 5th and 6th grade levels in secondary and imam hatip secondary schools, and as an elective course as two course hours per week at the 7th and 8th grades. The titles of the learning areas announced by the Ministry of National Education and published in the curriculum of the Information Technologies and Software course are determined as follows;

1. IT literacy,
2. Communicating, sharing information and expressing oneself through information technologies,
3. To be able to research, construct knowledge and work collaboratively,
4. Ability to solve problems, do programming and produce original products,

• Can develop a strategy in order to solve a problem and realize the project, use different perspectives and new approaches while producing a solution.

• Recognize what authorship and programming languages are, and use at least one programming language actively.

• It can create models, make simulations and create animations to examine subjects and systems (M.E.B., 2012).

It is thought that it would be appropriate to use the Scratch program and the Tospaa non-computer coding program in the Problem Solving, Programming and Original Product Development unit. The reason why we prefer to use these programs is that the Scratch program in the 6th grade Information Technologies and Software course of the Ministry of National Education is suitable for the age levels of the students and provides simultaneous progress with the curriculum. Again, the preference of the Tospaa program is that it meets the gains that students need to earn and it is an easy coding tool that can be accessed by all classes. Thanks to the Scratch program, students can design their own projects and produce creative solutions to the problems they encounter in real life (Karabak & Güneş, 2013; Lee, 2011).

In this study, the solution of existing problems was carried out by the students using Scratch and Tospaa programs. Since Scratch and Tospaa provided easy, visually interesting environments, students took an active role in the design environment during the problem solving phase.

This research aims to measure the students' attitudes towards the Computer and Software course while giving coding education to the students, to determine the students' self-efficacy perceptions towards the Computer and Software course, to measure the students' attitudes towards coding education, to measure the academic success of the students and to observe the differences in the educational outcomes resulting from these measurements. It is desired to determine in which of the computer-assisted and non-computer-assisted education environments the subjects comprehend the coding education more efficiently.

1. Will the coding education given to the students without using a computer make a significant difference after the pre-test and post-test?

2. Will the coding education that will be given to the students in the Computer Aided Education environment make a significant difference in the students after the pre-test and post-test?

3. What is the readiness level of students for the use of computer programs?

4. What are the students' prior learning about coding?

5. Was the teaching strategy of the course effective in the scores of the students in the academic achievement test?

METHOD

Quantitative research methods were used in this study, which examines the effects of coding education designed with different visual programs on the academic achievement, attitudes and self-efficacy of secondary school students.

In this study, unequal quasi-experimental design with pretest and posttest experimental and control groups was preferred (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2012). The experimental and control groups are selected from the groups by unbiased assignment. It is a method used when random selection is not possible. This method; It is a design that includes an experimental approach in which random distribution is not suitable for selecting subjects. It is a method that is implemented using pre-built classes.

In the study, students are divided into two groups as experimental and control groups (Karasar, 1999). In the control group, the lessons were taught using the Tospaa computer-free coding program (Tospaa, 2020). While the lessons were taught in this way in the control group; In the experimental group, lessons were taught with the support of Scratch software (ScratchAbout, 2020). The applications were made for 10 weeks in accordance with the duration of the lesson plan in the curriculum.

While the lessons were taught in this way in the control group; In the experimental group, lessons were taught with the support of Scratch software. In both groups, measurements are made before and after the experiment in the same way (Büyüköztürk et al., 2012). In the Experimental and Control groups, at the beginning and at the end of the research, the students were given an academic achievement test for coding, the Attitude Scale for Computer-Aided Education (Arslan, 2006b), the Self-Efficacy Perception Scale for Computer-Aided Education (Arslan, 2006a) and the Attitude Scale for Computer Games Assisted Coding Learning (Keçeci, Alan, & Zengin, 2016). Self-efficiency and perception regarding computer aided education scale it is a likert-type scale consisting of 20 items, The attitude to taking computer aided education scale is a 20-item likert-type scale, and The attitude scale for educational computer-assisted coding learning is a likert-type scale consisting of 28 questions. It is important to analyze the data as detailed and directly as possible with the statements of the study group, and it has been examined whether it is effective in learning outcomes based on the data obtained for the theory put forward with quantitative research (Creswell & Clark, 2017; Miles, Huberman, Huberman, & Huberman, 1994; Strauss & Corbin, 1998).

Study Group

The study group of the research consists of 6th grade primary school students studying at Meram Gödene TOKİ Imam Hatip Secondary School in Meram district of Konya in the 2020-2021 academic year. The research was implemented with distance education lasting 10 weeks. In the study, lessons were given by the same teacher in both the experimental and control groups. In the study, an experimental and a control group were formed in order to test how the independent variables affected the dependent variables. The study was carried out on a total of N= 45 students, with N=21 students in the experimental group and N=24 students in the control group.

Table 1. *Demographic data of the study group*

		N	**%**
Gender	Woman	17	37.7
	Male	28	62.3
Experimental group	Woman	7	29.1
	Male	14	66.9
Control group	Woman	10	41.6
	Male	14	58.4
Total		**45**	**100**

As can be seen from Table 1, 37.7% of the students in the study group of the research are female students and 62.3% are male students. The experimental group consisted of 29.1% female students and 66.9% male students; The control group consists of 41.6% female students and 58.4% male students.

Research Instruments and Processes

In order to measure the success of the students in coding, which was applied to both groups as a pre-test and post-test, the achievement test covering the problem solving and programming achievement in the 6th grade Information Technologies and software curriculum of the Ministry of National Education 2020/2021 was used.

The academic achievements of the students participating in the research were prepared as Scratch Academic Achievement Test and Tospaa Academic Achievement Test by the school informatics teachers who are experts in their field. There are 14 questions in the Scratch academic achievement test and 5 questions in the Tospaa academic achievement test.

The reliability coefficient of a multiple-choice test (academic achievement test) needs to be determined. For this, KR-20 and KR-21 formulas are generally used (Guven, 1990). When using this method, in order to create the data sets in the measurement tool during the application process, "1" points are given if there is an expected feature in the answers taken from the items, and a "0" point is given if there is no expected feature. For the determination of the internal reliability coefficient of the tests, the determined features are taken into account and the formula Kr-20 or Kr-21, whichever is more appropriate, is used (Ercan & Kan, 2004).

Kr-20 formula (Ergin, 1995);

n : number of items in the test

q : rate of those who did not answer an item correctly = (1-p)

P : rate of those who answered an item correctly

∑pq is the sum of the calculated (p x q)'s for each item

S^2 : variance of test total scores,

Kr-20 Formula

$$r_{iç} = \left(\frac{n}{n-1}\right)\left(\frac{S^2 - \Sigma pq}{S^2}\right)$$

The Kr-20 formula is used in cases where those whose items are not answered and those who give wrong answers are not evaluated, and those who give correct answers are evaluated. If the items in the test are to be evaluated with different scores, the Kr-20 formula cannot be used. If the difficulty values of the items in the test are close to each other, the Kr-21 formula can be used (Ergin, 1995).

Kr-21 formula (Ergin, 1995);

n : number of items in the test

Xt: Average of total scores

S^2: variance of test total scores;

Kr-21 Formula

$$r_{iç} = \left(\frac{n}{n-1}\right)\left(1 - \frac{\bar{X}_t(n - \bar{X}_t)}{nS_t^2}\right)$$

Table 2 and Table 3 show the table of specifications for the Scratch Academic Achievement Test and the Tospaa Academic Achievement test used in the study.

An example question from the Scratch academic achievement test is as follows;

Which of the following is the flow chart that starts and ends the algorithm? (10 points)

a) Ellipse

b) parallelogram

c) Rectangle

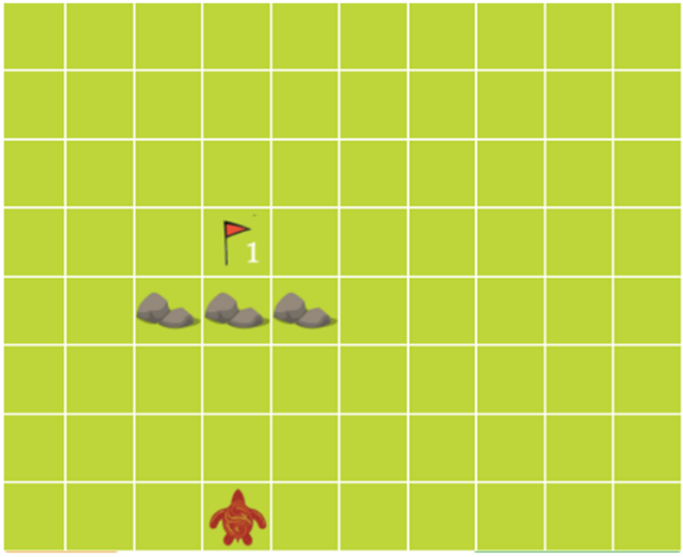
d) rhombus

Table 2 *Table of specifications for the preparation of the Scratch academic achievement test*

Questions	Achievements
1	Explain the concept of algorithm.
2	Explains flowchart components and functions.
3	Develops an algorithm for solving the problem.
4	Edits a faulty algorithm to work correctly
5,6,7,8,9	Recognize the interface and features of the block-based programming tool
10,11,12	Develops and organizes a program presented in a block-based programming tool according to the given criteria.

Our sample question from the Tospaa academic achievement test is as follows;

Deliver the balls to their target points



Tospaayı engellere değmeden hedeflere ulaştırın

Table 3 *Table of specifications for the preparation of the Tospaa academic achievement test*

Questions	Achievements
1	Explain the concept of algorithm.
2	Explains flowchart components and functions.
3	Develops an algorithm for solving the problem.
4	Edits a faulty algorithm to work correctly
5	Develops and organizes a program presented in a block-based programming tool according to the given criteria.

Considering the Kr-21 values for both multiple-choice tests, it was found that the difficulty index of the Scratch Academic Achievement Test = .758 and the difficulty index of the Tospaa Academic Achievement test = .726.

The results of the comparison (independent t-test for unrelated samples) of the results of the self-efficacy perception scale regarding computer assisted education, the attitude scale for computer assisted education and the attitude scale for educational computer games assisted coding learning applied to the experimental and control groups before the application (pre-tests) Table 4, Table 5, Table 6 and Table 7.

Table 4 *Pre-test comparison results of the self-efficacy perception scale for computer-assisted education between groups*

	Groups	N	$\overline{X}$	Ss	Sd	t	p
Pre-test	**Experimental group**	21	66,95	4,82	43	-,972	.336*
	Control group	24	65,57	4,71			

*p<0.05

After the experimental and control groups were determined before the application, in the pre-tests (experimental group pretest average =66.95; control group pretest mean =65.57) *.05<.336 for p<.05 significance level large and not significant. In other words, the pre-test scores of the participants on the Self-Efficacy Perception Scale for Computer Assisted Education do not show a significant difference.

Table 5 *Pre-test comparison results of the attitude scale for computer-assisted education between groups*

	Groups	N	$\overline{X}$	Ss	Sd	t	p
Pre-test	**Experimental group**	21	62,20	7,11	43	-1,433	.159*
	Control group	24	59,47	5,41			

*p<0.05

After the experimental and control groups were determined before the application, in the pre-tests (experimental group pre-test average =62.20; control group pre-test average =59.47) *.05<.159 for p<.05 significance level because it is not meaningful. In other words, the participants' Attitude Scale Towards Computer Assisted Education pre-test scores do not show a significant difference.

Table 6 *Pre-test comparison results of the attitude scale towards coding learning supported by educational computer games between groups*

	Groups	N	$\overline{X}$	Ss	Sd	t	p
Pre-test	**Experimental group**	21	92,20	13,91	43	- 1.003	.321*
	Control group	24	87,71	16,14			

*p<0.05

After the experimental and control groups were determined before the application, in the pre-tests (experimental group pre-test average =92.20; control group pre-test average =87.71) *.05<.321 for p<.05 significance level because it is not meaningful. In other words, the pre-test scores of the participants' Attitude Scale Towards Educational Computer Games Supported Coding Learning do not show a significant difference.

In other words, the study group has approximately similar numbers of experimental and control groups and the comparison of the pre-test results of the statistical tests (self-efficacy perception scale regarding computer-assisted education, attitude scale regarding computer-assisted education, attitude scale towards educational computer-assisted education-assisted coding learning) With these results, it was determined that both groups (experimental and control groups) were equivalent before the research and were suitable for the application of the research.

Data Analysis

The demographic information of the study group students was explained with descriptive statistics such as standard deviation, arithmetic mean, percentage, frequency. In the quantitative aspect of the study, the statistical package program SPSS 22 (Statistical Package for Social Sciences) version program was used for the analysis of the mathematical results obtained as a result of the experimental process.

RESULTS

In this part of the research, the research questions, the results of the statistical analyzes made according to the data collected from the research and the interpretations of the research questions on these results are presented in detail. Reliability Analysis Findings of the Self-Efficacy Perception Scale on Computer Assisted Education. Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .870 in the reliability test performed with the data collected from the study group after the application of the Self-Efficacy Perception Scale on Computer Assisted Education.

Table 7 *Reliability analysis results of the Self-Efficacy Perception Scale Regarding Computer Assisted Education*

Self-Efficacy Perception Scale on Computer Assisted Education	
Cronbach's Alfa	**Number of Items in the Scale**
.870	20

Reliability Analysis Findings of the Attitude Scale towards Computer Assisted Education

Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .81 in the reliability test performed with the data collected from the study group after the application of the Attitude Scale towards Computer Assisted Education.

Table 8 *Reliability analysis results of the attitude scale for computer assisted instruction*

Attitude Scale Towards Computer-Aided Education	
Cronbach's Alfa	**Number of Items in the Scale**
.81	20

Reliability Analysis Findings of the Attitude Scale towards Educational Computer Games Assisted Coding Learning

Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .92 in the reliability test performed with the data collected from the study group after the application of the Attitude Scale towards Educational Computer Games Supported Coding Learning.

Table 9 *Attitude scale towards coding learning supported by educational computer games*

Attitude scale towards coding learning supported by educational computer games	
Cronbach's Alfa	**Number of Items in the Scale**
.92	28

Experimental group Academic Achievement Test Pretest – Posttest comparison (t-test for dependent samples / paired t-test)

As a result of the application, the results of the comparison of the pre-test and post-tests made to determine the status of the experimental group students are given in Table 11.

Table 10 *Experimental group pretest-posttest comparison results for academic achievement test total*

	Test	**N**	$\overline{X}$	**Ss**	**Sd**	**t**	**p**
Experiment group	Pre-test	21	69,58	14,21	23	23,985	.000
	Final test	21	87,08	15,24			

*P<0.05

It was observed that there was a statistically significant difference between the pretest-posttest scores of the experimental group (pretest mean =69.58; posttest mean =87.08) for *p<.05 significance level (p<0.05). It was determined that the experimental group students increased their success in the academic achievement test as a result of the computerized coding application they participated in (Table 10).

Experimental group Self-Efficacy Perception Scale on Computer Assisted Education Pretest – Posttest comparison (t-test for dependent samples / paired t-test)

Comparisons of the pre-test and post-tests were made to determine the status of the experimental group students as a result of the application. The result is given in Table 11.

Table 11 *Experimental group pre-test-post-test comparison results for the self-efficacy perception scale related to computer-assisted education*

	Test	**N**	$\overline{X}$	**Ss**	**Sd**	**t**	**p**
Experiment group	Pre-test	21	66,95	4,82	23	68,016	.000
	Final test	21	73,79	4,13			

*P<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the experimental group (pretest average =66.95; posttest average =73.79) *p<.05 in terms of significance level

(p<0.05). It was determined that the students in the experimental group increased their Self-Efficacy Perceptions Regarding Computer Aided Education as a result of the computerized coding application they participated in (Table 11).

Experimental Group Attitude Scale Towards Computer-Aided Education Pre-Test – Post-Test Comparison (Paired T-Test)

The pre-test and post-tests made to determine the status of the experimental group students as a result of the application were compared. The result of this comparison is given in Table 12.

Table 12 *Experimental group pre-test-post-test comparison results for the attitude scale towards computer-assisted education*

	Test	N	$\overline{X}$	Ss	Sd	t	p
Experiment group	Pre-test	21	62,20	7,11	23	42,840	.000
	Final test	21	74,45	6,92			

*P<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the experimental group (pretest average =62.20; posttest average =74.45) *p<.05 in terms of significance level (p<0.05). It was determined that the students in the experimental group increased their Attitudes towards Computer-Aided Education as a result of the Scratch application they participated in (Table 12).

Experimental Group Attitude Scale Towards Learning Coding Supported by Educational Computer Games Pre-Test – Post-Test Comparison (Paired T-Test)

he pre-test and post-tests made to determine the status of the experimental group students as a result of the application were compared. The result of this comparison is given in Table 13.

Table 13 *Experimental group pre-test-post-test comparison results for the attitude scale towards educational computer games-assisted coding learning*

	Test	N	$\overline{X}$	Ss	Sd	t	p
Experiment group	Pre-test	21	92,20	13,91	23	32,469	.000
	Final test	21	95,54	9,53			

*P<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the experimental group (pretest average =92.20; posttest average =95.54) *p<.05 in terms of significance level (p<0.05). It was determined that the students in the experimental group increased their Attitudes towards Learning Coding Supported by Educational Computer Games (Table 13).

Control group Academic Achievement Test (Tospaa) Pretest – Posttest comparison (paired t-test)

In order to reveal the status of the control group students as a result of the application, comparisons of the pre-test and post-test were made. The result is given in Table 14.

Table 14 *Pretest-posttest comparison results for the total academic achievement test control group*

	Test	N	$\overline{X}$	Ss	Sd	t	p
Control Group	Pre-test	24	45,71	23,62	20	8,867	,000
	Final test	24	73,80	27,60			

*p<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the control group (pretest average =45.71; posttest average =73.80) *p<.05 in terms of significance level (p<0.05). As a result of the teaching conducted with the Tospaa application in which the control group students

participated, it was observed that there was a significant difference in their Academic Achievement and they increased their Academic Success (Table 14).

Control Group Self-Efficacy Perception Scale Regarding Computer Assisted Education Pre-Test – Post-Test Comparison (Paired T-Test)

In order to reveal the status of the control group students as a result of the application, comparisons of the pre-test and post-test were made. The result is given in Table 15.

Table 15 *The control group pretest-posttest comparison results for the self-efficacy perception scale related to computer assisted education*

	Test	N	$\overline{X}$	Ss	Sd	t	p
Control Group	Pre-test	24	65,57	4,71	20	63,693	.000
	Final test	24	78,19	4,61			

*p<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the control group (pretest mean =65.57; posttest mean =78.19) *p<.05 in terms of significance level (p<0.05). As a result of the teaching conducted with the Tospaa application in which the control group students participated, it was observed that there was a significant difference in Self-Efficacy Perceptions Regarding Computer Assisted Education (Table 15).

Control group Attitude towards Computer Assisted Education Pretest – Posttest comparison (paired t-test)

In order to reveal the status of the control group students as a result of the application, comparisons of the pre-test and post-test were made. The result is given in Table 16.

Table 16 *The control group pretest-posttest comparison results for the attitude scale towards computer-assisted education*

	Test	N	$\overline{X}$	Ss	Sd	t	p
Control Group	Pre-test	24	59,47	5,418	20	50,299	.000
	Final test	24	65,09	6,015			

*p<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the control group (pretest average =59.47; posttest average =65.09) *p<.05 in terms of significance level (p<0.05). As a result of the teaching conducted with the Tospaa application in which the control group students participated, it was observed that there was a significant difference in their Attitudes towards Computer Assisted Education (Table 16).

Control group Attitude Scale Towards Learning Coding Supported by Educational Computer Games Pre-test – Post-test comparison (paired t-test)

In order to reveal the status of the control group students as a result of the application, comparisons of the pre-test and post-test were made. The result is given in Table 17.

Table 17 *The control group pre-test-post-test comparison results for the attitude scale towards educational computer games-assisted coding learning*

	Test	N	$\overline{X}$	Ss	Sd	t	p
Control Group	Pre-test	24	87,71	16,14	20	24,904	.000
	Final test	24	85,57	14,13			

*p<0.05

In the application, it was found that there was a statistical difference between the pretest-posttest scores of the control group (pretest mean =87.71; posttest mean =85.57) *p<.05 in terms of significance level (p<0.05). As a result of the teaching conducted with the Tospaa application, in which the control group students participated, it was observed that there was a significant difference in their Attitudes towards Educational Computer Games Supported Coding (Table 17).

Comparison of experimental-control group Self-Efficacy Perception Scale for Computer Assisted Education post-tests (independent t-test)

Table 18 shows the result when the "Self-Efficacy Perception Scale Results of Computer Assisted Education" were compared between the students using the Scratch application in Computer Coding (experimental group) and the students using the Tospaa application (control group).

Table 18 *Results of the post-test comparison (t-test) between groups (experimental-control group) for the self-efficacy perception scale related to computer assisted education*

Groups		**N**	$\overline{X}$	**S**	**Sd**	**t**	**p**
Final test	Experimental group	21	78,19	4,61	43	3,373	.002*
	Control group	24	73,79	4,13			

*P<0.05

It is significant as it is .00 < .05 for *p<.05 significance level in the post-tests performed after the application to the experimental and control groups. In the post-tests (experimental group post-test average =78.19; control group post-test average =73.79), it was determined that the posttest scores of the experimental group were higher than the posttest scores of the control group (Table 18). The result obtained shows that the application is in favor of the experimental group regarding Self-Efficacy Perceptions Regarding Computer Assisted Education. In addition, eta square value was examined to determine the effect size of the computerized coding environment on the Self-Efficacy Perception Scale of Computer Assisted Education. Effect size values were calculated as η2= .133. In this case, considering the effect size value (η2 = 0.133), it can be said that the computerized coding environment has a "large" effect size on Self-Efficacy Perceptions Regarding Computer Assisted Education.

Comparison of experimental-control group Attitude Scale towards Computer Assisted Education post-tests (independent t-test)

Table 19 shows the result when the "Attitude Scale towards Computer Aided Education" scores of the students using the computer-aided coding Scratch application (experimental group) and the students using the Tospaa application (control group) were compared.

Table 19 *Intergroup (experimental - control group) post-test comparison (t - test) results of attitude scale towards computer-assisted education*

Groups		**N**	$\overline{X}$	**S**	**Sd**	**t**	**p**
Final test	Experimental group	21	74,45	6,92	43	-4,809	.000*
	Control group	24	65,09	6,01			

*P<0.05

It is significant as it is .00 <.05 for the *p<.05 significance level in the post-tests after the application to the experimental and control groups. In the post-tests (experimental group post-test average =74.45; control group post-test average =65.09), it was determined that the post-test scores of the experimental group were higher than the post-test scores of the control group (Table 19). This result shows that the application is for the benefit of the experimental group. In addition, eta square value was examined to determine the effect size of the computer coding environment on Attitudes towards Computer Assisted Education. Effect size values were calculated as

η2= .129. In this case, considering the effect size value (η2 = 0.129), it can be said that the computer coding environment has a “large” effect size on Attitudes towards Computer Assisted Education.

Comparison of the experimental-control group Attitude Scale towards Educational Computer Games Supported Coding Learning post-tests (independent t-test)

When the "Attitudes Towards Educational Computer Games Supported Coding Learning" of the students using the Scratch application in Computer Coding (experimental group) and the students using the Tospaa application (control group) are compared, the result is given in Table 20.

Table 20 *Intergroup (experimental - control group) post-test comparison (t - test) results of attitude scale towards educational computer games assisted coding learning*

Gruplar		**N**	$\overline{X}$	**S**	**Sd**	**t**	**p**
Final test	Experimental group	21	95,54	9,53	43	-2,805	.008*
	Control group	24	85,57	14,13			

*P<0.05

It is significant as it is .00 <.05 for the *p<.05 significance level in the post-tests after the application to the experimental and control groups. In the post-tests (experimental group post-test average =95.54; control group post-test average =85.57), it was determined that the experimental group's posttest scores were higher than the control group's posttest scores (Table 20). This result shows that the application is for the benefit of the experimental group. In addition, eta square value was examined to determine the effect size of the Attitude Scale towards Educational Computer Games Supported Coding Learning on the total. Effect size values were calculated as η2= .134. In this case, considering the effect size value (η2 = 0.134), it can be said that the computer coding environment has a “large” effect size on Attitudes Towards Educational Computer Games Supported Coding Learning.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

Within the scope of the research, demographic information forms, academic achievement test, self-efficacy perception scale related to computer-assisted education, attitude scale to computer-assisted education, attitude scales to coding learning supported by educational computer games, which were applied before the application process of 45 middle school students who made up the study group, were included in the study group. When the answers given were examined, the results were obtained according to the information obtained.

When the demographic information applied to 45 middle school 6th grade students who were considered within the scope of the research was examined, the results were obtained according to the information obtained. From the students in the study group of the research; female students make up N=17, that is 37.7%, and male students make up N= 28, that is, 62.3%. Of the students in the experimental group of the research; female students make up N= 7 ie 29.1%, male students N= 14 ie 69.9%. Of the students in the control group of the study; female students make up N= 10 ie 41.6%, male students N= 14 ie 58.4%.

When the Kr-21 values of the Scratch Academic Achievement Test and Tospaa Academic Achievement test, which are the multiple-choice tests used in the study, are examined, the difficulty index of the Scratch Academic Achievement Test was found to be = .758 and the difficulty index of the Tospaa Academic Achievement test = .726.

Comparison of the results of the academic achievement test, self-efficacy perception scale for computer assisted education, attitude scale for computer assisted education, and attitude scale for coding learning supported by educational computer games applied to the experimental and control groups before the application (pre-tests) (independent t- test) results, no significant difference was observed between the scores of the students. The comparison of the pre-tests and the experimental and

control group numbers of the study group and the comparison of the pre-test results of the statistical tests (self-efficacy perception scale for computer-assisted education, attitude scale for computer-assisted education, attitude scale for coding learning supported by educational computer games.), it was concluded that both groups (experimental and control groups) were equivalent before the research and were suitable for the application of the research.

Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .870 in the reliability test performed with the data collected from the study group after the application of the Self-Efficacy Perception Scale on Computer Assisted Education. Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .81 in the reliability test performed with the data collected from the study group after the application of the Attitude Scale towards Computer Assisted Education. Cronbach's Alpha reliability coefficient, which is the internal reliability coefficient, was found to be .92 in the reliability test performed with the data collected from the study group after the application of the Attitude Scale towards Educational Computer Games Supported Coding Learning.

It is significant as it is .00 < .05 for *p<.05 significance level in the post-tests performed after the application to the experimental and control groups. In the post-tests (experimental group post-test average =78.19; control group post-test average =73.79), it was determined that the post-test scores of the experimental group were higher than the post-test scores of the control group. The result obtained shows that the application is in favor of the experimental group regarding Self-Efficacy Perceptions Regarding Computer Assisted Education. In addition, eta square value was examined to determine the effect size of the computerized coding environment on the Self-Efficacy Perception Scale of Computer Assisted Education. Effect size values were calculated as η2= .133. In this case, considering the effect size value (η2 = 0.133), it can be said that the computerized coding environment has a "large" effect size on Self-Efficacy Perceptions Regarding Computer Assisted Education.

It is significant as it is .00 <.05 for the *p<.05 significance level in the post-tests after the application to the experimental and control groups. In the post-tests (experimental group post-test average =74.45; control group post-test average =65.09), it was determined that the post-test scores of the experimental group were higher than the post-test scores of the control group. This result shows that the application is for the benefit of the experimental group. In addition, eta square value was examined to determine the effect size of the computer coding environment on Attitudes towards Computer Assisted Education. Effect size values were calculated as η2= .129. In this case, considering the effect size value (η2 = 0.129), it can be said that the computer coding environment has a “large” effect size on Attitudes towards Computer Assisted Education.

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In the context of all these results, the fact that the Scratch application was made in a computerized environment encouraged students to learn. By using Scratch, one of the block-based coding tools, the students received a computer-applied coding training and the students followed the studies more actively. The researches and the data obtained show that suitable environments such as computer classes in schools should be created for computer coding in information technologies and software courses. On the other hand, we can predict that teachers of Information Technologies and Software

courses will improve their cognitive and algorithmic thinking skills if they give computer coding training to their students using different portals. In addition to all these, it is thought that it will be beneficial for the students to increase the information technology course hours in education and to open weekend courses for students in all schools where they are requested.

SUGGESTIONS

This section has been created to assist future studies based on the results obtained as a result of the study.

1. The data obtained in this study were obtained as a result of the application carried out in a limited study group for a limited time of 10 weeks. Conducting such a study with a large study group with a long-term application may make the results more generalizable.
2. The study was carried out in a distance education environment due to the Covid-19 outbreak. After the epidemic process is over, the study can be done in a face-to-face education environment and the results can be examined.
3. The study was conducted on 6th grade students, in a similar study it can be done on students from different grade levels and a different block coding tool.
4. As a result of the findings obtained from this research, it was concluded that the education provided in a computerized environment had a positive effect on students, and activities to encourage students in and out of school can be organized in order to spread computer-aided education. For this reason, students' participation in the coding week (Codeweek) is in the coding activities of the students; Developing analytical thinking and problem solving skills, creating games with web 2.0 tools, increasing their motivation and awareness, and raising awareness about the importance of coding.
5. This study, made with Scratch software, was conducted with 6th grade students in secondary school. The findings have been that teaching coding with Scratch affects academic success. Therefore, it can be said that Scratch, a software that supports and develops creativity for all ages, can be used at all levels from kindergarten to higher education.
6. Coding classes can be established in schools so that coding education can be carried out in accordance with its purpose. Students can also experience learning by doing in these classroom environments.

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REFERENCES

Arslan. (2006a). Self-Efficacy Perception Scale for Computer Assisted Education [Bilgisayar Destekli Eğitime İlişkin Öz Yeterlilik Algısı Ölçeği]. *Abant İzzet Baysal University Journal of the Faculty of Education, 3(*2), 24-33.

Arslan. (2006b). Attitude Scale Towards Performing Computer-Aided Education [Bilgisayar Destekli Eğitim Yapmaya İlişkin Tutum Ölçeği]. *Centennial University Journal of the Faculty of Education.*

Atun, H. & Usta, E. (2019). The effects of programming education planned with TPACK framework on learning outcomes. *Participatory Educational Research, 6(*2), 26-36. DOI: 10.17275/per.19.10.6.2

Baş, G. (2011). Investigation of Primary School Teachers' Educational Internet Use Self-Efficacy Beliefs in Terms of Different Variables [İlköğretim Öğretmenlerinin Eğitsel İnternet Kullanımı Öz- Yeterlik İnançlarının Farklı Değişkenler Açısından İncelenmesi]. *Educational Technology Theory and Practice, 1(*2), 35-51.

Batdal, G. (2005). Öğrenci Odaklı Bir Yaklaşımla İlköğretim Matematik Programlarının Değerlendirilmesi. XIV. Ulusal Eğitim Bilimleri Kongresi Kitabı, 343-346.

Büyüköztürk, Ş., Çakmak, E., Akgün, E., Karadeniz, Ş., & Demirel, F. (2012). Scientific Research Methods [Bilimsel Araştırma Yöntemleri]. (12th Edition). Ankara: Pegem Academy.

Creswell, J. W., & Clark, V. L. P. (2017). Designing and Conducting Mixed Methods Research: Sage publications.

Demir, G., & Seferoğlu, S. S. (2017). New Concepts, Different Uses: An Evaluation of Computational Thinking. Educational technologies readings, 801-830.

Ercan, İ., & Kan, İ. (2004). Ölçeklerde Güvenirlik ve Geçerlik.

Ergin, Y. D. (1995). Validity and Reliability in Scales.

Geçer, A. K., & Funda, D. (2010). Determination of Computer Literacy Levels: Example of Kocaeli University [Bilgisayar Okur-Yazarlık Düzeylerinin Belirlenmesi: Kocaeli Üniversitesi Örneği] (ss, 20-44). *Yüzüncü Yıl University Faculty of Education Journal, 7(*1), 20-44.

Gomes, A., & Mendes, A. J. (2007). Learning to Program-Difficulties and Solutions. Paper presented at the International Conference on Engineering Education–ICEE.

Karabak, D., & Güneş, A. (2013). Curriculum Recommendation in Software Development for Secondary School Freshmen. *Journal of Education and Training Research, 21(*2-3), 163-169.

Karasar, N. (1999). Scientific Research Method. Ankara: Nobel Publication Distribution.

Keçeci, G., Alan, B., & Zengin, F. K. (2016). Attitude Scale Towards Educational Computer Games Assisted Coding Learning: A Validity and Reliability Study. *Education Sciences, 11(*3), 184-194.

Kırkıç, K. A., & Aydın, E. (2018). Hello, STEM An Innovative Teaching Approach: Education Publishing House.

Lee, Y.-J. (2011). Scratch: Multimedia Programming Environment for Young Gifted Learners. *Gifted Child Today, 34(*2), 26-31.

M.E.B. (2012). Information Technologies and Software Course (5,6.7 and 8th Grades) Curriculum.

Malan, D. J., & Leitner, H. H. (2007). Scratch for Budding Computer Scientists. ACM Sigcse Bulletin, 39(1), 223-227.

Miles, M. B., Huberman, A. M., Huberman, M. A., & Huberman, M. (1994). Qualitative Data Analysis: An Expanded Sourcebook: sage.

Roy-Singh, R. (1991). Education for the Twenty-First Century: Asia-Pacific Perspectives: Unesco Principal Regional Office for Asia and the Pacific.

ScratchAbout. (2020), Retrieved from https://scratch.mit.edu/about/, Erişim Tarihi: 06.12.2020.

Somyürek, S. (2014). Attracting the Attention of Generation Z in the Teaching Process: Augmented Reality. *Educational Technology Theory and Practice, 4(*1), 63-80.

Strauss, A., & Corbin, J. (1998). Basics of Qualitative Research Techniques: Sage publications Thousand Oaks, CA.

Tospaa. (2020). Tospaa Bilgisayarsız Kodlama Oyunu. Retrieved from http://tospaa.org/, Erişim Tarihi: 03.09.2019.

Tsai, M.-J., & Tsai, C.-C. (2003). Information Searching Strategies in Web-Based Science Learning: The Role Of Internet Self-Efficacy. *Innovations in education and Teaching International, 40(*1), 43-50.

Ünsal, K. (2019). Investigation of Secondary and High School Administrators' Views on Coding Education (Bağcılar District Example) (Master's Thesis), Marmara University.

Yildirim, A., & Simsek, H. (2008). Qualitative research methods in the social sciences. Ankara: Seçkin Publications.

Yildirim, B., & Selvi, M. (2017). An experimental study on the effects of stem applications and mastery learning. Theory and Practice in Education, *13(*2), 183-210.