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Investigation of Secondary School Students' Attitudes Towards Computational Thinking, Problem-Solving Skills and Research-Inquiry

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Abstract

In the current study, it is aimed to examine middle school students' computational thinking, problem solving skills and their attitudes towards research inquiry of the information technologies course, which is taught with the method of constructivist approach. The study was carried out in accordance with the pre-posttest experimental design. 14 girls and 8 boys in a middle school 5th grade were included to the study. The data was collected in Kırşehir in the second semester of 2018-2019. Within the scope of the study, "Problem Solving Inventory", "Computational Thinking Skill Scale" and "Attitude Scale Towards Research-Inquiry" was used at the beginning and end of the application. As a result of the study, it was observed that there was a significant difference in the post-test scores between the "avoidance" sub-dimension of the problem solving skills of middle school students and the total score obtained from the problem solving skill scale. In addition, the significant difference obtained between the total score the students got from the inquiry-oriented attitude scale and the sub-dimensions of curiosity, value. Finally, avoidance is in the direction of the posttest score.

Keywords: Computational thinking, inquiry-oriented attitude, middle school students, problem solving skills, social constructivist theory, 5E teaching method.

Introduction

The developments in science and technology have had a direct impact on the learning and teaching habits of individuals and societies. In this process, it is expected that the individual will have characteristics that produce, develop and functionally use knowledge, be entrepreneurial and determined, and contribute to society and culture (MEB, 2018). The sense of curiosity in individuals whose needs and expectations are increasing day by day and who are trying to reshape themselves led them to research and discovery (Damar et al., 2017). Individuals of this age are expected to produce new knowledge and apply it to new situations and problems, instead of taking existing knowledge immediately (Wagner, 2008). Thus, individuals start the problem solving process by making an effort to cope with the problems (Özyürek & Begde, 2016). Problem solving is a basic skill required for today's students (Kozikoğlu, 2019). An individual's knowing what s/he wants and revealing it effectively depends on his/her problem-solving skills (Zembat, Tunçeli, & Akşin Yavuz, 2017). Individual skills play a major role in solving any problem faced by the individual (Özyürek & Begde, 2016; Tümkaya & İflazoğlu, 2000; Yılmaz & Dost, 2016). Understanding and solving problem situations is defined as an individual's ability to engage in cognitive processing (Shute et al., 2016). Problem solving is a complex process that requires cognitive as well as affective and psychomotor skills (Oral et al., 2018; Tüysüz, 2013). Problem solving helps the child learn how to learn (Ülküer, 1988). Children need to acquire problem-solving skills in order to solve the problems they encounter (Ekici & Balım, 2013). Individuals who have problem-solving skills, especially at a young age, adapt more easily to the environment they live in (Senemoğlu, 2012; Zembat et al., 2017). That is why, previous experiences contribute to the solution of the problems encountered (Durgun & Önder, 2019). A research and inquiry-based approach is adopted for the solution of problems (Demir, 2016, Öner & Yılmaz, 2019). Since questioning is a way of thinking (Karademir & Saracaloğlu, 2013), individuals with problem-solving skills are constantly in search and questioning. In the inquiry approach, students are active in the learning process (Gülhan & Yurdatapan, 2014) and are expected to think at a higher level (Demir, 2016; Lim, 2001). This is an effective way that the learner uses in the learning process

(Demir, 2016). It is aimed to direct students to the subjects they are interested in and to gain scientific thinking skills and to raise questioning individuals in the way of problem solving (Açıkgöz & Sağır, 2020; Karamustafaoğlu & Pool, 2016; Kardaş & Yeşilyaprak, 2015). With the questions asked during the lesson, which takes place with the logic of inquiry, changes will be made in the students' perspectives (Bilir, 2015). In this way, every place where students can research and question will turn into an educational environment (Öz, 2015). With the increase in the use of technology in educational environments, it is possible for students to access information themselves by applying research and inquiry-based learning (Kozikoğlu & Camuşcu, 2019). Supporting the learning process with technology positively affects learning skills (Hopson et al., 2002). Technological opportunities increase the ways of accessing information (Seferoğlu & Akbıyık, 2005). Thus, technology provides new opportunities to guide students and teachers in the inquiry process (Kırılmazkaya, 2014). Gaining research and questioning skills to students ensures that attitudes towards research are positive (Ozan & Karamustafaoğlu, 2020). With the research-inquiry approach, students have the opportunity to design their research, collect and analyze data (Kırılmazkaya, 2014). Students are required to reach a problem solution by drawing conclusions from this situation and to construct the solutions obtained.

The inquiry-based learning approach is based on the constructivist approach, which is the basis of other contemporary learning approaches and is emphasized as the most effective way for students to learn (Bilir, 2015; Duban, 2008). This approach, which tries to build knowledge from the ground up, is based on knowledge and learning rather than teaching (Aykan & Tatar, 2017). In this approach, learning takes place with the help of mental and social processes (Evrekli, Didem, Balım, & Kesercioğlu, 2009). Since some skills are important in updating, applying, criticizing and analyzing information, the constructivist approach plays an important role in the field of education (Adak, 2017). Constructivism increases the success of students and completely affects the learning process with the development of their creative abilities (Çelebi, 2006). The learning process provides students with the ability to think, question and explain by making them active, interactive and positive (Jack, 2017). The learning environment also provides a positive effect on the psychological characteristics of students (Kemankaşlı & Gür, 2016). In the process, it is essential for the student to discover, discuss and research information together with the teacher (Balcı, 2007). The student provides learning by interacting with his/her active effort and environment (Fidan & Duman, 2014). The constructivist approach aims to raise individuals with advanced problem-solving skills who can use and develop new technologies, make decisions in every way, and assume responsibilities (Yıldırım & Altan, 2017). In this approach, all knowledge is based on previous knowledge (Gupta & Gupta, 2017) and students construct new knowledge with their existing knowledge (Hançer, 2016).

The age we live in envisages raising individuals equipped with high-level cognitive knowledge and skills and the competencies required by the age. Within the scope of this prediction, it is thought that the adaptation abilities of individuals are very important. Regardless of the individual's circumstances, by observing the dynamics of the relevant conditions, it is important that they have the knowledge, skills and competencies to adapt very quickly to the relevant situation. In this case, computational thinking and problem-solving skills come to mind. Computational thinking skills are expressed as a combination of creativity, algorithmic thinking, critical thinking, problem solving and collaborative working skills (ISTE, 2015). Computational

thinking systematizes the problem-solving skills of individuals and enables them to expand their thinking boundaries. For example, Yadav, Mayfield, Zhou, Hambrusch, and Korb (2014) argue that computational thinking is an effective mental process used to formulate problems and express solutions in computer science terms. When students who realize these mental processes learn the concepts and principles of information technologies and improve themselves, they can be better prepared for their daily life and careers with the support of technology (Gülbahar, Kert, & Kalelioğlu, 2019). In addition, students are expected to develop a positive attitude towards research and inquiry. That is why, attitude is an important factor that activates behavior (Davis, Bagozzi, & Warshaw, 1989). These skills that an individual has gained can help his/her cope with problems by considering the conditions s/he is in. However, the individual is also likely to need some research methods in problem solving and computational thinking. In this regard, the development of a positive attitude towards inquiry may also have an impact on one's ability to adapt to changing and transforming conditions. At this point, it is thought that the dynamic structure of the information technologies course will work by integrating it with a pedagogical infrastructure. Based on all these arguments, in this study, it is aimed to examine the effect of secondary school students' information technologies course, which is carried out with a constructivist approach, on their computer thinking and problem solving skills and their attitudes towards research and inquiry.

Research Questions

Information technologies course taught with the constructivist approach method of secondary school students;

1. Is there a statistically significant effect on problem solving skills, confidence, and self-control and avoidance behaviors?
2. Is there a statistically significant effect on computational thinking skills, creativity, algorithmic thinking skills, collaboration, critical thinking and problem solving skills?
3. Is there a statistically significant effect on attitude towards questioning, curiosity, value, and avoidance?

Method

Study Design

In the research, the effect of the information technologies course, which was held with the constructivist approach method for secondary school students, on their computational thinking and problem solving skills and their attitudes towards research and inquiry was examined. In the research, a poor experimental design based on the single group pretest posttest model, which is one of the quantitative research methods, was used. Among the experimental designs, single-group designs in which random assignment cannot be made on the sample and there is no control group are called poor experimental designs because they cannot provide these features (Büyüköztürk et al., 2013).

Participants

The study group in the research consists of 14 female and eight male students in a state secondary school in the city center of Kırşehir in the 2018-2019 academic year, the second semester. Studies that include an information technology course in the curriculum and the

necessity of acquiring computer thinking skills at an early age (Grover, 2017; Park & Kwon, 2022; Parmar, Lin, Dsouza et al., 2022; Rich, Bartholomev, Daniel et al., 2022) forms the basis in deciding the participants. In addition, in the selection of the study group whose mainstay is computer thinking skills, there are also studies that reveal the problem-solving skills associated with computational thinking skills (Lai & Wong, 2022; Luo, Israel & Gane, 2022; Voon, Wong, Wong et al., 2022) and the attitude towards research inquiry (Hava & Koyunlu Ünlü, 2021). Thus, these related studies has been effective in deciding study group. As a result, the effect of the variables that are related to each other in the literature on the secondary school students of the information technologies course, which is taught with a constructivist approach, will be revealed.

Data Collection Process

In the data collection process, firstly, after the necessary permissions were obtained from the Provincial Directorate of National Education, the administrators of the school where the application would be carried out, the information technology course teacher and the students who took the course were informed about the content of the research. The data collection process was carried out with the students for seven weeks in the second semester of the 2018-2019 academic year.

Data Collection Tools

In the data collection process of the research, the Problem Solving Inventory (Serin et al., 2010), which measures the problem-solving skills of primary school students, the Computational Thinking Skill Levels Scale (Korkmaz et al., 2015), which measures the computational thinking skills of secondary school students, and the Research-Inquiry Oriented Attitude Scale (Ebren et al., 2016), which measures attitudes towards the secondary school students' research-questioning skills.

Problem Solving Inventory

The "Problem Solving Inventory", which consists of a total of 24 items, has a structure with three dimensionsThe "Problem Solving Inventory", which consists of a total of 24 items, has a structure with three dimensions. Each dimension was expressed as confidence in problem solving skills with 12 items, self-control with 7 items, and avoidance with 5 items. As a result of exploratory factor analysis (EFA), it explains 42.26% of the total variance. The Cronbach alpha reliability value, which was developed by Serin et al. (2010) and calculated for the entire scale, is 0.80 and the test-retest reliability value is 0.85. The Cronbach alpha value was 0.86 according to Ocak et al. (2021), 0.85 according to Yurtseven et al. (2021), 0.80 according to Demir (2022), 0.83 according to Or and Bal (2021). The related studies suggested that the scale has an up-to-date and reliable structure.

Computational Thinking Skill Scale

The “Computational Thinking Skill Scale", which consists of 22 items in total, has a structure consisting of five dimensions. Each dimension includes 4 items: creativity, algorithmic thinking, collaboration and critical thinking, so it was expressed as 6-item problem solving. Cronbach's alpha value was used for reliability in the scale, and this value was 0.81 (Korkmaz et al., 2015). The Cronbach alpha value was 0.76 according to Çevik et al. (2021), 0.85 according to

Özgür (2020), 0.85 according to Kirmit, Dönmez & Çataltaş, (2018). The related studies suggested that the scale has an up-to-date and reliable structure.

Research Inquiry Attitude Scale

Consisting of a total of 13 items, the "Research-Inquiry Oriented Attitude Scale" has a three-dimensional structure. Each dimension was expressed as “curiosity” and “value” with 4 items and “avoidance” with 5 items. As a result of EFA, it explains 48.42% of the total variance. Cronbach's alpha value was used for reliability in the scale, and this value was 0.76 (Ebren et al., 2016). Özcan (2021) found the Cronbach alpha reliability value to be 0.80, while Kozikoğlu and Camuşçu (2019) found it to be 0.76.

Procedure

Weekly processes and activities carried out within the scope of the study are given in Table 1.

Table 1. *Procedures carried out within the scope of the study*

Week	Activity
1 st week	Within the scope of the research, pre-tests were applied to the students before starting the research.
2 nd week	Within the scope of the I Think Logically Unit in the lesson plan, Information - Operators and Operators were mentioned within the scope of Operation Priority. On the basis of Constructivist Theory; 1. Have you ever seen people around you called operators? And “For example, what do you think “Computer operator” means?” questions were asked and it was tried to be explained by discussing this issue with the students. 2. A game was played with the help of a smart board in order to distinguish the operators and they were asked to use the operators effectively. 3. By observing the students, they were helped with the subjects they were curious about and the subjects they were stuck with.
3 rd week	Algorithm examples were made within the scope of an Algorithm Tale included in the lesson plan. On the basis of Constructivist Theory; 1. “This story was a slightly modified version of a story you've probably heard before. Did you notice a different word in the story that you hadn't heard before?" and what did the word “Algorithm” in the story evoke for you?” questions were asked and discussed. 2. “What is an Algorithm?” It was said that the answer to the question would be learned and the Algorithm was explained. 3. A discussion environment was prepared about what the algorithm would do in daily life. 4. During the implementation process, students were observed and feedbacks were given. 5. Students were expected to make their own algorithms. Students were observed and their deficiencies were corrected and feedback was given.
4 th week	Flowcharts were made within the scope of I Change the Flow Unit in the lesson plan. On the basis of Constructivist Theory; 1. The teacher was asked what the Flowchart photo in his hand was. 2. They were told that they would create Flow Charts as a problem case. 3. “What connection do Algorithms and Flowcharts have?” the question was asked. A discussion environment was prepared for the students.

Table 1. *Procedures carried out within the scope of the study (continuation-1)*

5 th week	As a subject in the lesson plan, code blocks were introduced on the Blockly site within the scope of Block-Based Programming. On the basis of Constructivist Theory; 1. The students were asked about the applications described in the previous lessons in order to check their foreknowledge and to reflect on it. They were asked which code blocks were used. Considering the answers given, what was done and which code blocks were useful was discussed. 2. They were asked what caught their attention in the code blocks on the Blockly site. Feedback was given according to the answers received. 3. During the application, the students were observed and feedbacks were given to the students. And students' inquiry and research was supported. 4. Students were supported to present their practices in a more original way.
6 th week	Within the scope of the Programming Child Game unit in the lesson plan, the students were made to play with the SCRATCH program. On the basis of Constructivist Theory; 1. Students' knowledge is reviewed by asking what we have covered in previous lessons. In the applications made, the described code blocks are mentioned again. 2. The students were given information about the game to be played. 3. The students were asked to do the stages of the game on the smart board step by step on their computers. 4. Students were observed while they were doing their applications and feedback was given to the students. And students' inquiry and research was supported. 5. Students who could not do it were helped.
7 th week	Post-tests were applied to conclude the study and compare the data.

Data Analysis

In the analysis of the data performed with the SPSS program, the researchers aimed to discover if there is a significant difference in the pretest and posttest measurements of the group was examined with the related samples t-test, or not. To determine the characteristics of the study group, percentage (%) and frequency (f) values indicating descriptive statistics, mean score, standard deviation, maximum and minimum, and kurtosis and skewness values (<-1,5;>+1,5) were used to determine descriptive statistics (Tabachnick & Fidell, 2013). In the last stage, Pearson correlation coefficient was used to determine the effects between variables.

Constructivist Approach Followed in the Scope of the Activity: 5E Model

In the study, the process was carried out on the basis of the 5E teaching method on the basis of the constructivist approach. In this context, lesson plans were created about how the lesson was taught every week in the study, and the steps of introduction, discovery, explanation, deepening and evaluation were used in the implementation of the lesson plans (Appendix 1).

Ethical Permissions of the Study

In this study, all the rules specified to be followed within the scope of "Higher Education Institutions Scientific Research and Publication Ethics Directive" were complied with. None of the actions specified under the heading "Actions Contrary to Scientific Research and Publication Ethics", which is the second part of the directive, have been taken. In line with these rules, Kırşehir Ahi Evran University, Social and Humanities Scientific Research and Publications Ethics Committee approved this study to be carried out.

Findings

Within the scope of the research, the mean, standard deviation, maximum and minimum, kurtosis and skewness values for the variables of "Problem Solving Skills", "Computational Thinking Skills" and "Attitude towards Research and Inquiry" and their sub-dimensions are shown in Table 2.

Table 2. *Descriptive statistics of the variables of the study*

	N	Minimum	Maximum	Mean	Standard deviation	Kurtosis	Error	Skewness	Error
Confidence in problem solving skills posttest	22	34,00	50,00	42,86	3,92	-,378	,491	,820	,953
Self-control posttest	22	10,00	30,00	19,41	4,64	-,101	,491	,646	,953
Avoidance posttest	22	6,00	18,00	11,64	3,17	,219	,491	-,386	,953
Avoidance pretest	22	6,00	25,00	16,23	5,58	,120	,491	-,958	,953
Self-control pretest	22	11,00	31,00	22,05	6,11	-,149	,491	-1,245	,953
Confidence in problem solving skills pretest	22	31,00	60,00	45,50	6,49	,286	,491	,795	,953
Problem solving skill scale total score posttest	22	62,00	86,00	73,91	6,55	-,058	,491	-,343	,953
Problem solving skill scale total score pretest	22	59,00	111,00	83,77	15,12	,130	,491	-,902	,953
Creativity posttest	22	13,00	19,00	16,87	1,75	-,704	,491	-,303	,953
Computational thinking skills scale total score posttest	22	62,00	90,00	75,36	7,99	,070	,491	-,733	,953
Algorithmic thinking posttest	22	8,00	19,00	14,09	3,49	-,453	,491	-1,075	,953
Collaboration posttest	22	8,00	19,00	14,95	2,80	-,977	,491	,925	,953
Critical thinking Posttest	22	8,00	19,00	13,82	2,86	-,028	,491	-,602	,953
Problem solving posttest	22	11,00	23,00	16,50	3,47	,045	,491	-1,091	,953

Table 2. *Descriptive statistics of the variables of the study (continuation-1)*

Computational thinking skills scale total score pretest	22	66,00	102,00	80,55	9,89	,635	,491	-,394	,953
Creativity pretest	22	13,00	20,00	17,22	2,07	-,370	,491	-,615	,953
Algorithmic thinking pretest	22	9,00	19,00	14,09	2,76	,046	,491	-,511	,953
Cooperation pretest	22	9,00	20,00	15,82	2,56	-,737	,491	1,077	,953
Critical thinking pretest	22	7,00	20,00	14,59	3,54	-,654	,491	,059	,953
Problem solving pretest	22	11,00	26,00	18,68	4,09	-,036	,491	-,732	,953
Attitude towards research inquiry total score pretest	22	25,00	50,00	37,64	6,32	-,077	,491	-,408	,953
Curiosity pretest	22	9,00	19,00	14,36	3,33	-,010	,491	-1,276	,953
Value pretest	22	8,00	14,00	10,86	1,67	-,236	,491	-,508	,953
Avoidance (attitude) pretest	22	7,00	19,00	12,27	3,56	,366	,491	-1,042	,953
Attitude towards research inquiry total score posttest	22	38,00	65,00	51,14	8,16	-,069	,491	-,860	,953
Curiosity posttest	22	13,00	20,00	16,91	2,16	-,372	,491	-,830	,953
Value posttest	22	11,00	20,00	15,86	2,95	-,282	,491	-,882	,953
Avoidance (attitude) posttest	22	9,00	25,00	17,82	5,22	-,140	,491	-1,235	,953

Findings of the Experimental Process

The results for the question are given in Table 3 about one of the sub-problems of the research is "Does the information technologies course based on the constructivist approach method have a statistically significant effect on the problem solving skill confidence sub-dimension of secondary school students?"

Table 3. *T-test results regarding the sub-dimension of confidence in problem solving skills*

	$\bar{X}$	N	S	SD	t	p
Pretest	42.86	22	3.92	8.27	-1.496	0.15
Posttest	45.50	22	6.49			

*<0.05; **<0.01

According to Table 3, there is no significant difference in the pretest and posttest scores of middle school students' confidence in problem solving sub-dimension (t(8.27)=-1.496, p>0.05). While the average scores of the students in the pretest were $\bar{X}$=42.86, it was observed that the posttest average scores were $\bar{X}$=45.50. When these results are examined, it can be said that although it is seen that the information technologies course based on the constructivist approach method leads to an increase in the sub-dimension of confidence in problem solving skills, this increase is not significant.

Table 4 provides the results for one of the sub-problems of the research is "Does the information technologies course based on the constructivist approach method have a statictically significant effect on the self-control sub-dimension of secondary school students?"

Table 4. *Related samples t-test results for the Self-Control sub-dimension*

	$\bar{X}$	N	S	SD	t	p
Pretest	19.41	22	4.63	7.42	-1.666	0.111
Posttest	22.04	22	6.11			

*<0.05; **<0.01

In Table 4, it was seen that the pretest and posttest scores of secondary school students for the sub-dimension of self-control did not differ significantly (t (7.42) =-1.666, p>0.05). While the pretest scores of the students were $\bar{X}$=19.41 before the application, it was seen that the posttest scores were $\bar{X}$=22.04 after the application. Accordingly, it can be said that the information technologies course based on the constructivist approach method did not significantly affect the self-control skills of the students.

One of the sub-problems of the research is "Is there a positive and significant effect in the avoidance sub-dimension of secondary school students of the information technologies course based on the constructivist approach method?", and the results for the question are shown in Table 5.

Table 5. *Related samples t-test results for the avoidance sub-dimension*

	$\bar{X}$	N	S	SD	t	p
Pretest	11.64	22	3.17	6.92	-3.112	0.005**
Posttest	16.23	22	5.58			

*<0.05; **<0.01

In Table 5, it is observed that the pretest and posttest scores of secondary school students for the avoidance subscale differ significantly (t (6.92) =-3.112, p<0.01). While the pretest scores of the students were $\bar{X}$=11.64 before the application, the posttest scores were found to be $\bar{X}$=16.23 after the application. When these results are examined, it is revealed that there is a significant decrease (reverse item) in the avoidance behaviors of the information technologies course based on the constructivist approach method.

One of the sub-problems of the research is "Is there a positive and significant effect on the total score of problem solving skills of secondary school students in the information technologies

course based on the constructivist approach method?", and the results for the question are shown in Table 6.

Table 6. *Related samples t-test results regarding the total score obtained from the problem solving skill scale*

	X̄	N	S	SD	t	p
Pretest	73.91	22	6.54	17.25	-2.681	0.014*
Posttest	83.77	22	15.12			

*<0.05; **<0.01

In Table 6, it is seen that the pretest and posttest scores of the students' total scores after the problem solving skill scale differ significantly (t (17.25) =-2.681, p<0.05). While the pretest scores of the students were X̄=73.91 before the application, it was seen that the posttest scores were X̄=83.77 after the application. Accordingly, it can be said that the information technologies course based on the constructivist approach method forms a significant increase in the total score of problem solving skills in students.

Table 7 displays the results on one of the sub-problems of the research is "Does the information technologies course based on the constructivist approach method have a statistically significant effect on the creativity sub-dimension of secondary school students?"

Table 7. *Related samples t-test results related to creativity sub-dimension*

	X̄	N	S	SD	t	p
Pretest	16.86	22	1.75	2.44	-0.699	0.492
Posttest	17.23	22	2.07			

*<0.05; **<0.01

In Table 7, it is seen that the pretest and posttest scores of the students for the creativity sub-dimension do not differ significantly (t (2.44) =-0.699, p>0.05). While the pretest scores of the secondary school students were X̄=16.86 before the application, the posttest scores were found to be X̄=17.23 after the application. According to this result, it can be said that the information technologies course based on the constructivist approach method did not have a significant effect on the creativity sub-dimension of the students.

One of the sub-problems of the research is "Does the information technologies course based on the constructivist approach method have a statistically significant effect on the algorithmic thinking sub-dimension of secondary school students?", and the results for the question are shown in Table 8.

Table 8. *Related samples t-test results related to algorithmic thinking sub-dimension*

	X̄	N	S	SD	t	p
Pretest	14.09	22	3.49	4.32	0.000	1.000
Posttest	14.09	22	2.76			

*<0.05; **<0.01

In Table 8, it is seen that the pretest and posttest scores of the students for the algorithmic thinking sub-dimension did not differ significantly (t (4.32) =0.000, p>0.05). While the pretest scores of the students were $\bar{X}$=14.09 before the application, the posttest scores were found to be $\bar{X}$=14.09 after the application. According to this result, it can be said that the information technologies course based on the constructivist approach method did not have a significant effect on the algorithmic thinking sub-dimension of the students.

One of the sub-problems of the research is "Is there a positive and significant effect in the cooperation sub-dimension of secondary school students of the information technologies course based on the constructivist approach method?", and the results for the question are shown in Table 9.

Table 9. *Related samples t-test results related to cooperation sub-dimension*

	$\bar{X}$	N	S	SD	t	p
Pretest	14.95	22	2.80	3.23	-1.256	0.223
Posttest	15.82	22	2.56			

*<0.05; **<0.01

When Table 9 is examined, it is seen that the pretest and posttest scores of the students for the cooperation sub-dimension do not differ significantly (t (3.23) =-1.256, p>0.05). While the pretest scores of the students were $\bar{X}$=14.95 before the application, the posttest scores were $\bar{X}$=15.82 after the application. This result shows that the information technologies course based on the constructivist approach method did not have a significant effect on the cooperation sub-dimension of the students.

One of the sub-problems of the research is “Is there a significant effect in the sub-dimension of critical thinking of secondary school students of the information technologies course based on the constructivist approach method?”, and the results for the question are shown in Table 10.

Table 10. *Related samples t-test results for the critical thinking sub-dimension*

	$\bar{X}$	N	S	SD	t	p
Pretest	13.82	22	2.85	4.51	-0.803	0.431
Posttest	14.59	22	3.54			

*<0.05; **<0.01

When Table 10 is examined, it is seen that the pretest and posttest scores of the students for the critical thinking sub-dimension do not differ significantly (t (4.51) =-0.803, p>0.05). While the pretest scores of the secondary school students were $\bar{X}$=13.82 before the application, it was seen that the posttest scores were $\bar{X}$=14.59 after the application. Accordingly, it can be said that the information technologies course based on the constructivist approach method did not have a significant effect on the students' critical thinking sub-dimension.

One of the sub-problems of the research is “Does the information technologies course based on the constructivist approach method have a statistically significant effect on the problem

solving sub-dimension of secondary school students?", and the results for the question are shown in Table 11.

Table 11. *Related samples t-test results related to problem solving sub-dimension*

	X̄	N	S	SD	t	p
Pretest	13.82	22	2.85	4.51	-0.803	0.431
Posttest	14.59	22	3.54			

*<0.05; **<0.01

When Table 11 is examined, it is seen that there is no significant difference between the pretest and posttest scores of the students for the problem solving subscale (t (5.21) =-1.962, p>0.05). It was observed that the pretest scores of the secondary school students were X̄=16.50 before the application, while the posttest scores were X̄=18.68 after the application. According to this result, it can be said that the information technologies course based on the constructivist approach method did not have a significant effect on the problem solving sub-dimension of the students.

One of the sub-problems of the research is "Does the information technologies course based on the constructivist approach method have a statistically significant effect on the computational thinking total score of secondary school students?", and the results for the question are shown in Table 12.

Table 12. *Related samples t-test results regarding the total score obtained from the computational thinking skill scale*

	X̄	N	S	SD	t	p
Pretest	75.36	22	7.99	11.71	-2.076	0.050
Posttest	80.54	22	9.88			

*<0.05; **<0.01

When Table 12 is examined, it was seen that the pretest and posttest scores of the students for the total score obtained from the computational thinking skill scale did not differ significantly (t (11.71) =-2.076, p>0.05). While the pretest scores of the students were X̄= 75.36 before the application, the posttest scores were X̄= 80.54 after the application. Accordingly, it can be said that the information technologies course based on the constructivist approach method did not have a significant effect on the total score of the students' computational thinking skills.

One of the sub-problems of the research is ""Does the information technologies course based on the constructivist approach method have a statşstşcally significant effect on the curiosity sub-dimension of secondary school students?", and the results for the question are shown in Table 13.

Table 13. *Related samples t-test results for the sense of curiosity sub-dimension*

	X̄	N	S	SD	t	p
Pretest	14.36	22	3.33	4.31	-2.772	0.011*
Posttest	16.91	22	2.16			

*<0.05; **<0.01

When Table 13 is examined, it was seen that the pretest-posttest scores of the students for the sub-dimension of curiosity did not differ significantly (t (4.31) =-2.772, p<0.05). While the pretest scores of the students were $\bar{X}$=14.36 before the application, it was seen that the posttest scores were $\bar{X}$=16.91 after the application. Accordingly, it can be said that the information technologies course based on the constructivist approach method has a positive and significant effect on the students' sense of curiosity sub-dimension.

One of the sub-problems of the research is "Does the information technologies course based on the constructivist approach method have a statistically significant effect on the value sub-dimension of secondary school students?" and the results for the question are shown in Table 14.

Table 14. *Related samples t-test results for the value sub-dimension*

	$\bar{X}$	N	S	SD	t	p
Pretest	10.86	22	1.67	3.28	-7.149	0.000**
Posttest	15.86	22	2.95			

*<0.05; **<0.01

When Table 14 is examined, it is seen that the pretest and posttest scores of the students belonging to the sense of worth sub-dimension differ significantly in the positive direction (t (3.28) =-7.149, p<0.05). While the pretest scores of the students were $\bar{X}$=10.86 before the application, the posttest scores were $\bar{X}$=15.86 after the application. Accordingly, it can be said that the information technologies course based on the constructivist approach method has a positive and significant effect on the students' sense of value sub-dimension.

One of the sub-problems of the research is "Does the information technologies course based on the constructivist approach method have a statistically significant effect on the avoidance attitude sub-dimension of secondary school students?", and the results for the question are shown in Table 15.

Table 15. *Related samples t-test results related to the avoidance attitude sub-dimension*

	$\bar{X}$	N	S	SD	t	p
Pretest	12.27	22	3.56	5.10	-5.094	0.000**
Posttest	17.82	22	5.22			

*<0.05; **<0.01

When Table 15 is examined, it is seen that the pretest and posttest scores of the students regarding the avoidance attitude sub-dimension differ significantly (t (5.10) =-5.094, p<0.05). While the pretest scores of the students were $\bar{X}$=12.27 before the application, the posttest scores were found to be $\bar{X}$=17.82 after the application. According to this situation, it can be said that the information technologies course based on the constructivist approach method has a positive and significant effect on the avoidance attitude sub-dimension of the students.

Table 16 shows the results on one of the sub-problems of the research is "Does the information technologies course based on the constructivist approach method have a statistically

significant effect on the total score of middle school students' attitudes towards research and inquiry?"

Table 16. *Related samples t-test results regarding the total score obtained from the research questioning attitude scale*

	$\bar{X}$	N	S	SD	t	p
Pretest	37.64	22	6.32	8.49	-7.459	0.000**
Posttest	51.14	22	8.16			

*<0.05; **<0.01

When Table 16 is examined, it is seen that the pretest and posttest scores of the students regarding the total score obtained with the attitude scale towards research inquiry differed significantly (t (8.49) =-7.459, p<0.05). While the pretest scores of the students were $\bar{X}$=37.64 before the application, it was seen that the posttest scores were $\bar{X}$=51.14 after the application. Accordingly, it can be said that the information technologies course based on the constructivist approach method creates a significant effect on the total score of the students' attitude scale towards research and inquiry.

Conclusion and Discussion

According to the results, it was determined that secondary school students' avoidance sub-dimension in the problem solving inventory and the total score obtained from the problem solving inventory differed significantly from their posttest scores. It is seen that there are similar and different results with the related literature. Problem solving skill is defined as the ability to find a solution based on a process (Santrock, 2011). Instead of solving the problem as a result of a problem, concepts such as marginalizing the problem, keeping it away from the real problem or being irrelevant are called "avoidance" (Serin et al., 2010). According to studies supporting the results of the research, Yöyen et al. (2017) also found that there is a positive effect between "approach-avoidance", which is the sub-dimension of problem solving skills. In another study conducted with the students of the faculty of education, it was observed that although there was no significant difference in the problem solving confidence scale values in the classes in different branches, there was a significant difference in the avoidance values (Otacıoğlu, 2007). In the study conducted with secondary school 7th grade students, it was stated that there is a positive and weak effect between problem solving and problem-solving skills sub-factor avoidance (Durgun & Önder, 2019). Saracaloğlu et al. (2001) stated that there was a significant differentiation according to the departments in the avoidance approach sub-dimension in terms of problem solving skill inventory. In the study conducted by Özdemir (2019), it was determined that there were significant effects between adolescents' aggression levels, problem-solving skills and approach-avoidance sub-dimensions.

In the current study, it was seen that the significant difference between the total score obtained by the secondary school students from the research-inquiry-oriented attitude scale and the sub-dimensions of curiosity, value and avoidance was also related to the posttest score. When the studies supporting this study are examined, Saraçoğlu and Kahyaoğlu (2018) stated that there is a positive significant effect between the perceptions of scientific inquiry skills of secondary

school students and their curiosity, motivation and attitudes towards the Science course. In another study, it was determined that there was a moderate, positive and significant effect between middle school students' attitudes towards research and inquiry and their flipped learning levels (Kozikoğlu & Camuşcu, 2019). Ozan and Karamustafaoğlu, (2020) in their study on teaching middle school students research and questioning skills, stated that the average of valuing and avoidance skills of the experimental group increased for both skills and there was a positive difference in favor of the experimental group.

In the study, it was seen that there was no significant difference in the sub-dimensions of computational thinking skills of secondary school students, creativity, algorithmic thinking, collaboration, critical thinking and problem solving. In this case, it can be said that the sub-dimensions will affect each other positively in the process. When the studies showing that creative skills can develop in the process are examined, Karakuş (2001) states that how creativity can be developed rather than its importance in the education process is discussed, and that creative thinking and problem solving are learnable skills. At the same time, teachers' creativity is important for the development of students' creativity (Trnova, 2014). Kobsiripat (2015) concluded in his study that coding activities would improve students' creativity. Basarmak (2019) stated that as a result of the study in which he examined the effect of digital teaching material development process on creative thinking skills, pre-service teachers had positive opinions about the lesson, had fun and had a productive time with group work. In a study conducted by Kirmit et al. (2018) on the computational thinking skills of gifted secondary school students, it was found that gender had a positive effect in favor of male students in terms of algorithmic, critical and creative thinking skills. Yünkül et al. (2017) examined the effect of students on computational thinking skills and stated that Block-based Scratch applications can have a positive effect on algorithm and creative thinking skills and problem solving. Finally, Sulistiyo and Wijaya also state that high school students have the potential to develop their skills in understanding concepts and modeling problems, which are part of their computational thinking skills. When all these results are examined, it is thought that the technological environment provided to the students, the materials and the many applications to be carried out may have a significant effect on the increase in the computational thinking skills of the students. Computational thinking improves students' problem-solving skills and increases their productivity in the process (ISTE, 2015). It aims to reveal skills such as creativity and critical thinking, etc. in increasing problem solving skills with the use of computational thinking and technology (Oluk et al, 2018). Coding practices carried out in the process can provide logical-analytical and algorithmic thinking, approaches to problem solving (Pala & Mıhcı-Türker, 2019). Carrying out coding trainings in student life at young ages will create effective gains for the development of students (Akdoğan, 2020).

Recommendations and Limitations

This study is limited to the method and participants on which it is based. In future studies, it may be possible to in-depth interpretation of the results obtained by referring to the opinions of the students. In addition, a study can be conducted to reveal the direct and indirect effects of the variables of problem solving skills, computational thinking and attitude towards inquiry and inquiry within the framework of an integrated model. Besides, by measuring the effect of the underlying method with a permanence test or supporting it with a qualitative study, strengths

and weaknesses can be revealed regarding the significant differences obtained. Thus, in the experimental process carried out within the scope of the study, the result obtained in the variable of computational thinking and its sub-dimensions can be explained in a more comprehensive way scientifically. Finally, in future studies, the experimental process can be planned longer, the current study, which is based on the 5E constructivist approach, can be expanded with individual and group work practices enriched with psycho-motor and affective domain gains.

References

Açıkgöz, D., & Sağır, Ş. U. (2020). Fen alanı öğretmenlerin araştırma sorgulamaya dayalı öğretime yönelik farkındalıkları. [Investigation of science teachers awareness towards inquiry based teaching]. *Karaelmas Eğitim Bilimleri Dergisi*, *8*(1), 10-26. https://dergipark.org.tr/en/pub/kebd/issue/67224/1049147

Adak, S. (2017). Effectiveness of constructivist approach on academic achievement in science at secondary level. *Educational Research and Reviews*, *12*(22), 1074-1079. http://doi: 10.5897/ERR2017.3298

Akdoğan, E. A. (2020). *Eğitsel robotik kodlama dersi veren öğretmenlerin öğretim programlarındaki kazanımlara yönelik görüşleri* [The views of the teachers educational robotic coding course about objectives of the curriculum] [Unpublished doctoral dissertation]. Bursa Uludağ University.

Aykan, A., & Tatar, M. (2017). Ortaokul öğretmenlerinin yapılandırmacı yaklaşım ile ilgili yeterlik düzeyleri. [Presence of competence related to the protective approach of secondary school authorities]. *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi*, *5*(2), 381-395. http://doi: 10.18506/anemon.287791

Balcı, A. S. (2007). *Fen öğretiminde yapılandırmacı yaklaşım uygulamasının etkisi* [Effect of applying constructivism in science teaching] [Unpublished master dissertation]. Selçuk University, Konya.

Basarmak, U. (2019). The effect of digital teaching material (public service ad) development process on preservice teachers' creative thinking skills. *Malaysian Online Journal of Educational Technology*, *7*(4), 126-144. http://dx.doi.org/10.17220/mojet.2019.04.009

Bilir, U. (2015). *Fen bilimleri öğretiminde araştırma ve sorgulamaya dayalı öğrenme sürecinin öğrencilerin akademik başarısına etkisi [impact of inquiry-based learning process on academic achievement of students in science teaching]* [Unpublished master dissertation]. Uludağ University, Bursa.

Büyüköztürk, Ş., Akgün, Ö. E., Karadeniz, Ş., Demirel, F., & Kılıç, E. (2013). Bilimsel araştırma yöntemleri [Scientific research methods]. Pegem Publishing.

Çelebi, C. (2006). *Yapılandırmacılık yaklaşımına dayalı işbirlikli öğrenmenin ilköğretim 5. sınıf sosyal bilgiler dersinde öğrenci erişi ve tutumlarına etkisi [The Effect of cooperative learning based to constructive approach to students achevement and attitudes at primary school 5th year social studies lesson]* [Unpublished master dissertation]. Selçuk University, Konya.

Çevik, M., Barış, N., Şirin, M., Ortak Kılınç, Ö., Kaplan, Y., Atabey Özdemir, B., Yalçın, H., Şeref, G., Topal, S., & Delice, T. (2021). The effect of digital activities on the technology awareness and computational thinking skills of gifted students (eTwinning project example). *International Journal of Modern Education Studies, 5*(1), 205-244. https://dergipark.org.tr/en/download/article-file/2169887

Damar, A., Durmaz, C., & Önder, İ. (2017). Ortaokul öğrencilerinin FeTeMM uygulamalarına yönelik tutumları ve bu uygulamalara ilişkin görüşleri. [Middle school students' attitudes towards STEM applications and their opinions about these applications]. *Journal of MultidisciplinaryStudies in Education*, *1*(1), 47-65. https://dergipark.org.tr/en/download/article-file/479351

Demir, Ö. D. (2016). Ortaokul öğrencilerinde problem çözme ve bilişsel farkındalık beceri düzeylerinin incelenmesi. [An investigation of secondary school students' levels of problem solving and metacognitive skills]. *Kastamonu Eğitim Dergisi*, *24*(2), 789-802. https://dergipark.org.tr/en/download/article-file/209738

Demir, S. (2022). Effectiveness of the leadership skills development program for gifted children: Leadership skills development program for gifted children. *International Journal of Curriculum and Instruction*, *14*(1), 693-718. http://ijci.wcci-international.org/index.php/IJCI/article/view/860/455

Duban, N. (2008). *İlköğretim fen ve teknoloji dersinin sorgulamaya dayalı öğrenme yaklaşımına göre işlenmesi: Bir eylem araştırması [Conducting science and technology course through inquiry-based learning approach in primary education: An action research]* [Unpublished doctoral dissertation]. Anadolu University, Eskişehir.

Durgun, E., & Önder, İ. (2019). Ortaokul 7. sınıf öğrencilerinin fen bilimleri başarıları ile okuduğunu anlama, grafik okuma ve problem çözme becerileri arasındaki ilişki. [The relationship of science achievement with reading comprehension, graphic reading, problem solving skills in middle school seventh grade students]. *Journal of Individual Differences in Education*, *1*(1), 1-13. https://dergipark.org.tr/en/download/article-file/724818

Ebren Ozan, C., Korkmaz, Ö., & Karamustafaoğlu, S. (2016). Ortaokul öğrencileri için araştırma–sorgulamaya dönük tutum ölçeği. [The attitude scale towards researchquestioning for secondary school students]. *Amasya Üniversitesi Eğitim Fakültesi Dergisi, 5*(2), 483-509. https://dergipark.org.tr/en/download/article-file/271632

Ekici, D. İ., & Balım, A. G. (2013). Ortaokul öğrencileri için problem çözme becerilerine yönelik algı ölçeği: Geçerlilik ve güvenirlik çalışması. [Problem solving skills perception scale for secondary students: a study of validity and reliability]. *Yüzüncü Yıl Üniversitesi Eğitim Fakültesi Dergisi*, *10*(1), 67-86. https://dergipark.org.tr/en/download/article-file/146231

Evrekli, E., Didem, İ., Balım, A. G., & Kesercioğlu, T. (2009). Fen öğretmen adaylarının yapılandırmacı yaklaşıma yönelik tutumlarının incelenmesi. [Investigation of science teacher candidates' attitudes towards constructivist approach]. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi*, *22*(2), 673-687. https://dergipark.org.tr/en/download/article-file/153389

Fidan, N. K., & Duman, T. (2014). Sınıf öğretmenlerinin yapılandırmacı yaklaşımın gerektirdiği niteliklere sahip olma düzeyleri. [Classroom teachers' possession level of characteristics required by the constructivist approach]. *Eğitim ve Bilim*, *39*(174), 143-159. http://dx.doi.org/10.15390/EB.2014.2027

Gupta, R., & Gupta, V. (2017). Constructivist approach in teaching. *International Journal of Humanities and Social Sciences*, *6*(5), 77-88. ISSN(E): 2319-3948.

Gülhan, F., & Yurdatapan, M. (2014). Araştırma sorgulamaya dayalı etkinliklerin çevre ile ilgili tutum ve davranışlara etkisi. [The effects of inquiry based activities that are convenient for 5e model on the environmen-related attitudes and behaviours of 5th grade students}. *Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *11*(27), 237-258. https://dergipark.org.tr/en/download/article-file/183139

Hançer, A. H. (2016). Enhancing learning though constructivist approach in science education. *International Journal of Environmental and Science Education*. *1*(2), 181-188. http://www.ijese.net/makale_indir/IJESE_1262_article_581f14c9d70b9.pdf

Hopson, M. H., Simms, R. L., & Knezek, G. A. (2002). Using a technology-enriched environment to improve higherorder thinking skills. *Journal of Research on Technology in Education, 34*(2), 109-120. https://doi.org/10.1080/ 15391523.2001.10782338

ISTE (2015). *Computational thinking in K–12 education*. https://cdn.iste.org/www-root/ct-documents/ct-leadershipt-toolkit.pdf?sfvrsn=4.

Jack, G. U. (2017). The effect of learning cycle constructivist-based approach on students academic achievement and attitude towards chemistry in secondary schools in north-eastern part of Nigeria. *Educational Research and Reviews*, *12*(7), 456-466. https://doi.org/10.5897/ERR2016.3095

Karademir, Ç. A., & Saracaloğlu, A. S. (2013). Sorgulama becerileri ölçeğinin geliştirilmesi: geçerlik ve güvenirlik çalışması. [The development of inquiry skills scale: reliability and validity study]. *Asya Öğretim Dergisi*, *1*(2), 56-65. https://dergipark.org.tr/en/download/article-file/17636

Karakuş, M. (2001). Eğitim ve yaratıcılık. [Education and creativity]. *Eğitim ve Bilim*, *26*(119), 3-7. http://213.14.10.181/index.php/EB/article/view/5220/1392

Karamustafaoğlu, S., & Havuz, A. C. (2016). Fen bilgisi öğretmen adaylarının araştırma-sorgulamaya dayalı öğrenme algılarının incelenmesi. [The investigation of prospective science education teachers' perception related to the inquiry based learning]. *Amasya Üniversitesi Eğitim Fakültesi Dergisi*, *5*(1), 233-247. http://doi:10.17539/aej.58949

Kardaş, F., & Yeşilyaprak, B. (2015). Eğitim ve öğretimde güncel bir yaklaşım: Teknoloji destekli esnek öğrenme (flipped learning) modeli. [A current approach to education: Flipped learning model]. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi, 48*(2), 103-121. https://kitaplar.ankara.edu.tr/xmlui/bitstream/handle/20.500.125

Kemankaşlı, N., & Gür, H. (2016). Yapılandırmacı öğrenme ortamının öğrencilerin sosyal ve psikomotor becerileri ile psikolojik ve bilişsel özelliklerine etkisi. [The effect of the constructivist learning environment on student social and psycho-motor skills, psychological and cognitive characteristics]. *Trakya Üniversitesi Eğitim Fakültesi Dergisi*, *6*(1), 78-88. https://dergipark.org.tr/en/download/article-file/200420

Kırılmazkaya, G. (2014). *Web tabanlı araştırma-sorgulamaya dayalı fen öğretiminin öğretmen adaylarının kavram öğrenmeleri ve bilimsel süreç becerilerinin geliştirilmesi üzerine etkisi [*The effects of web based inquiry science teaching development on preservice teachers concept learning and scientific process skills] [Unpublished doctoral dissertation]. Fırat University, Elazığ.

Kirmit, Ş., Dönmez, İ., & Çataltaş, H. E. (2018). Üstün yetenekli öğrencilerin bilgisayarca düşünme becerilerinin incelenmesi. [The study of gifted students' computational thinking skills]. *Journal of STEAM Education*, *1*(2), 17-26. https://dergipark.org.tr/en/download/article-file/615394

Kobsiripat, W. (2015). Effects of the media to promote the scratch programming capabilities creativity of elementary school students. *Procedia-Social and Behavioral Sciences, 174*, 227-232. https://doi.org/10.1016/j.sbspro. 2015.01.651

Korkmaz, Ö., Çakır, R., & Özden, M. Y. (2015). Bilgisayarca düşünme beceri düzeyleri ölçeğinin (bdbd) ortaokul düzeyine uyarlanması. [Computational thinking levels scale (ctls) adaptation for secondary school level]. *Gazi Eğitim Bilimleri Dergisi*, *1*(2), 143-162.

Kozikoglu, I. (2019). Investigating critical thinking in prospective teachers: metacognitive skills, problem solving skills and academic self-efficacy. *Journal of Social Studies Education Research*, *10*(2), 111-130. https://www.learntechlib.org/p/216567/

Kozikoğlu, İ., & Camuşcu, K. (2019). Ortaokul öğrencilerinin ters yüz öğrenme hazırbulunuşlukları ile araştırma/sorgulamaya yönelik tutumları arasındaki ilişki. [Relationship between secondary school students' flipped learning readiness and attitudes towards researching/questioning]. *Yaşadıkça Eğitim, 33*(2), 187-201. http://doi: 10.33308/26674874.2019332132

Lai, X., & Wong, G. K. W. (2022). Collaborative versus individual problem solving in computational thinking through programming: A meta-analysis. *British Journal of Educational Technology, 53(*1), 150-170. https://doi.org/10.1111/bjet.13157

Lim, B. (2001). *Guidelines for designing inquiry-based learning on the Web: Online professional development of educators* [Doctoral dissertation]. Indiana University, U.S.A.

Luo, F., Israel, M., & Gane, B. (2022). Elementary computational thinking ınstruction and assessment: a learning trajectory perspective. *ACM Transactions on Computing Education (TOCE), 22(*2), 1-26. https://doi.org/10.1145/3494579

Milli Eğitim Bakanlığı (MEB) (2018). *Bilgisayar bilimi dersi öğretim programı (ilkokul ve ortaokul 4, 5, 6 ve 7. sınıflar).* MEB.

Ocak, G., Doğruel, A. B., & Tepe, M. E. (2021). An analysis of the relationship between problem solving skills and scientific attitudes of secondary school students. *Journal of Contemporary Educational Research*, *8*(1), 72-83. https://doi.org/10.33200/ijcer.780710

Oluk, A. Korkmaz, Ö., & Oluk, H. A. (2018). Scratch'ın 5. sınıf öğrencilerinin algoritma geliştirme ve bilgi-işlemsel düşünme becerilerine etkisi. [Effect of Scratch on 5th graders' algorithm development and computational thinking skills]. *Türk Bilgisayar ve Matematik Eğitimi Dergisi*, *9(*1), 54-71. http://doi: 10.16949/turkbilmat.399588

Or, M. B., & Bal, A. P. (2021). Ortaokul öğrencilerinin problem çözme algıları ile matematik başarıları arasındaki ilişkinin incelenmesi. [Investigation of the relationship between the problemsolving perception levels and mathematics achievement of secondary school students]. *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *30*(2), 154-165. https://doi.org/10.35379/cusosbil.906891

Oral, S., Paksoy, A., & Liman, B. (2018). Sağlık Meslek Yüksekokulu öğrencilerinin empatik ve problem çözme becerilerinin incelenmesi. [Analysis of empathic and problem-solving skills of health vocational high school students]. *Karamanoğlu Mehmetbey Üniversitesi Sosyal Bilimler Araştırma Dergisi*, *1*(1), 108-122. https://dergipark.org.tr/en/download/article-file/608086

Otacıoğlu, S. G. (2007). Eğitim fakültelerinin farklı branşlarında eğitim alan öğrencilerin problem çözme beceri düzeylerinin karşılaştırılması. [The comparison of problem solving skills of post graduate students in teacher's colleges in terms of their levels]. *Eurasian Journal of Educational Research (EJER)*, (29). 73-83.

Ozan, C. E., & Karamustafaoğlu, S. (2020). Yönlendirmeli sorgulamaya uygun öğretimin araştırma sorgulamaya dönük tutum ve öz yeterlilik algısı üzerine etkisi. [The effect of teaching appropriate to guided inquiry towards inquiry based research on attitude and self-efficacy perception]. *Academia Eğitim Araştırmaları Dergisi*, *5*(2), 43-64. https://dergipark.org.tr/en/download/article-file/1188218

Öner, G., & Yılmaz, Y. Ö. (2019). Ortaokul öğrencilerinin problem çözme ve sorgulayıcı öğrenme becerileri algıları ile stem'e yönelik algı ve tutumları arasındaki ilişkinin incelenmesi. [Investigation of relationship between middle school students' problem-solving and inquiry learning skills perceptions and their perceptions and attitudes towards STEM]. *Cumhuriyet Uluslararası Eğitim Dergisi*, *8*(3), 837-861. http://dx.doi.org/10.30703/cije.574134

Öz, R. (2015). *Araştırma ve sorgulamaya dayalı etkinliklerle desteklenmiş bilim merkezi uygulamalarının 7. sınıf öğrencilerinin akademik başarılarına, bilim okuryazarlıklarına ve sorgulayıcı düşünme becerilerine etkisi [The effect of science center applications developed according to inquiry based learning approach on 7th graders' academic achievement, scientific literacy and skills of inquiry learning]* [Unpublished master dissertation]. Marmara University, İstanbul.

Özcan, M. (2021). Ortaokul Öğrencilerinin Araştırma-Sorgulamaya Yönelik Tutumları. [Research-questioning attitudes of secondary school students]. *OPUS International Journal of Society Researches*, *18*(44), 8261-8279. https://doi.org/10.26466/opus.892503

Özdemir, B. (2019). *Ortaokul öğrencilerinin problem çözme becerilerinde otomatik düşüncelerinin ve karar verme stillerinin rolü [The role of automatic thought and decision making style of middle school students on problem solving skills]* [Unpublished master dissertation]. Maltepe University, İstanbul.

Özgür, H. (2020). Relationships between Computational Thinking Skills, Ways of Thinking and Demographic Variables: A Structural Equation Modeling. *International Journal of Research in Education and Science*, *6*(2), 299-314. https://files.eric.ed.gov/fulltext/EJ1250676.pdf

Özyürek, A., & Begde, Z. (2016). Öğretmen ve anne-baba tutumlarının okul öncesi dönem çocuklarının problem çözme becerilerine etkisi. [Effects of teachers and parents' attitudes on the problem solving skills of preschool children]. *Amasya Üniversitesi Eğitim Fakültesi Dergisi*, *5*(1), 204-232. http://doi:10.17539/aej.07642

Pala, F. K., & Mıhcı-Türker, P. (2019). Öğretmen adaylarının programlama eğitimine yönelik görüşleri. [Opinions of teacher candidates on programming education]. *Kuramsal Eğitimbilim Dergisi, 12*(1), 116-134. http://dx.doi.org/10.30831/akukeg.399921

Park, W., & Kwon, H. (2022). Bringing computational thinking to technology education classrooms: Hacking car activity for middle schools in the republic of korea. *International Journal of Technology and Design Education,* 1-19. https://doi.org/10.1007/s10798-022-09750-5

Parmar, D., Lin, L., Dsouza, N., Joerg, S., Leonard, A. E., Daily, S. B., & Babu, S. (2022). How Immersion and Self-Avatars in VR Affect Learning Programming and Computational Thinking in Middle School Education. *IEEE Transactions on Visualization and Computer Graphics*. https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9762800

Rich, P. J., Bartholomew, S., Daniel, D., Dinsmoor, K., Nielsen, M., Reynolds, C., ... & Yauney, J. (2022). Trends in tools used to teach computational thinking through elementary coding. *Journal of Research on Technology in Education*, 1-22. https://doi.org/10.1080/15391523.2022.2121345

Santrock, J.W. (2011). *Educational Psychology*. McGraw Hill

Saracaloğlu, A. S., Serin, O., & Bozkurt, N. (2001). Dokuz eylül üniversitesi eğitim bilimleri enstitüsü öğrencilerinin problem çözme becerileri ile başarıları arasındaki ilişki. [The relationship between the problem solving skills and the achievement of graduate students of the graduate school of educational sciences]. *Atatürk Eğitim Fakültesi Eğitim Bilimleri Dergisi, 14*, 121-134. https://dergipark.org.tr/en/download/article-file/2128

Saraçoğlu, M., & Kahyaoğlu, M. (2018). Ortaokul öğrencilerinin bilimsel sorgulama becerileri algılarının, merak, motivasyon ve tutum açısından incelenmesi. [Examination of secondary school students' scientific inquiry skills perceptions in term of curiosity, motivation and attitude]. *Journal of Computer and Education Research*, *6*(12), 358-376. https://doi.org/10.18009/jcer.472673

Seferoğlu, S. S., & Akbıyık, C. (2005). İlköğretim öğretmenlerinin bilgisayara yönelik öz-yeterlik algıları üzerine bir çalışma. [A study on primary school teachers' perceived computer self-efficacy]. *Eğitim Araştırmaları, 19*, 89-101.

Senemoğlu, N. (2012). *Gelişim öğrenme ve öğretim: Kuramdan* uygulamaya *[Developmental learning and teaching: From theory to practice] (21st edition).* Pegem Publishing.

Serin, O., Serin, N. B., & Saygılı, G. (2010). İlköğretim düzeyindeki çocuklar için problem çözme envanterinin (ÇPÇE) geliştirilmesi. [Developing Problem Solving Inventory for Children at the Level of Primary Education (PSIC)]. *İlköğretim Online*, *9*(2), 446-458. https://dergipark.org.tr/en/download/article-file/90752

Shute, V. J., Wang, L., Greiff, S., Zhao, W., & Moore, G. (2016). Measuring problem solving skills via stealth assessment in an engaging video game. *Computers in Human Behavior*, *63*, 106-117. https://doi.org/10.1016/ j.chb.2016.05.047

Sulistiyo, M. A. S., & Wijaya, A. (2020, July). The effectiveness of inquiry-based learning on computational thinking skills and self-efficacy of high school students. In *Journal of Physics: Conference Series. 1581(*1), 012046). OP Publishing.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics (Sixth edition).* United States: Pearson Education.

Trnova, E. (2014). IBSE and creativity development. *Science Education International, 25*(1), 8-18.

Tümkaya, S., & İflazoğlu, A. (2000). Çukurova üniversitesi sınıf öğretmenliği öğrencilerin otomatik düşünce ve problem çözme düzeylerinin bazı sosyo-demografik değişkenlere göre incelenmesi. [An investigation of automatic thought and problem solving levels of students in classroom teaching unit of çukurova university according to some socio-demographic variables]. *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 6(6), 143–152. https://dergipark.org.tr/tr/download/article-file/50057

Tüysüz, C. (2013). Üstün yetenekli öğrencilerin problem çözme becerisine yönelik üstbiliş düzeylerinin belirlenmesi. [Determination of gifted students' metacognition level about problem solving skills]. *Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 10*(21), 157-166. https://dergipark.org.tr/en/download/article-file/182887

Ülküer, N. S. (1988). Çocuklara problem çözme becerisi nasıl kazandırılır? [How do children gain problem-solving skills?]. *Yaşadıkça Eğitim Dergisi, 5*, 28-32.

Wagner, S. (2008). *To know where he lies: DNA technology and the search for Srebrenica's missing*. Univ of California Press.

Voon, X. P., Wong, S. L., Wong, L. H., Khambari, M. N. M., & Abdullah, S. I. S. S. (2022). Developing Computational Thinking Competencies through Constructivist Argumentation Learning: A Problem-Solving Perspective. *International Journal of Information and Education Technology, 12(*6). https:// doi: 10.18178/ijiet.2022.12.6.1650

Yadav, A., Mayfield, C., Zhou, N., Hambrusch, S., & Korb, J. T. (2014). Computational thinking in elementary and secondary teacher education. *ACM Transactions on Computing Education (TOCE), 14(*1), 1-16. https://doi.org/10.1145/2576872

Yıldırım, M., & Altan, S. T. (2017). Araştırma ve sorgulamaya dayalı öğrenme yaklaşımının ilkokul öğrencilerinin bilimsel süreç becerilerine etkisi. [Effect of inquiry-based learning approach on primary school pupils' science process skills]. *Mustafa Kemal Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *14*(38), 71-89. https://dergipark.org.tr/en/download/article-file/329319

Yılmaz, E., & Dost, M. T. (2016). Polislerin kişilerarası problem çözme becerileri ile öfke ve öfke ifade tarzları. [Interpersonal problem solving skills, anger and anger expression styles of police officers]. *Türk Psikolojik Danışma ve Rehberlik Dergisi*, *6*(46), 15-34. https://dergipark.org.tr/en/download/article-file/631406

Yöyen, E. G., Azaklı, A., Üney, R., Demirci, O. O., & Merdan, E. (2017). Ergenlerin kişilik özelliklerinin problem çözme becerisi üzerine etkisi. [The effect of adolescent's personality traits on problem solving skilL]. *Doğu Anadolu Sosyal Bilimlerde Eğilimler Dergisi*, *1*(1), 75-93. https://dergipark.org.tr/en/download/article-file/293613

Yurtseven, R., Akkas Baysal, E., & Ocak, G. (2021). Analysis of the Relationship between Decision Making Skills and Problem Solving Skills of Primary School Students. *International Online Journal of Education and Teaching*, *8*(3), 2117-2130. https://files.eric.ed.gov/fulltext/EJ1308060.pdf

Yünkül, E., Durak, G., Çankaya, S., & Mısırlı, Z. A. (2017). Scratch yazılımının öğrencilerin bilgisayarca düşünme becerilerine etkisi. [The effects of scratch software on students' computational thinking skills]. *Necatibey Eğitim Fakültesi Elektronik Fen ve Matematik Eğitimi Dergisi*, *11*(2), 502-517. https://doi.org/10.17522/balikesirnef.373424

Zembat, R., Tunçeli, H. İ., & Akşin Yavuz, E. (2017). Okul öncesi öğretmenlerinin sınıf yönetimi becerileri ile problem çözme becerileri arasındaki ilişkinin incelenmesi. [Study of the relations between classroom management and problem solving abilities of preschool teachers]. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *18*(3), 24-43. https://dergipark.org.tr/en/download/article-file/1487132

BIOGRAPHICAL NOTES

Contribution Rate of Researchers

Author 1: %25

Author 2: %25

Author 3: %25

Author 4: %25

All authors took an equal part in all processes of the article. All authors have read and approved the final version of the study.

Conflict Statement

The authors declare that there is no conflict of interest with any institution or person within the scope of the study.

APPENDIX 1

EXAMPLE: ACTIVITY 1

LESSON PLAN

I. PREPARATION

Course Name: Information Technologies and Software Course

Class: 5th grade

Unit Name: I Think Logically

Subject Title: Information - Operators and Process Priority

Duration: 40'

Teaching Methods and Techniques: Lecture, Research-Inquiry, Thinking, Evaluation

Source Tools and Equipment: PC, Smart Board

Acquisition:

1. Gives examples of operators that can be used in problem solving.

2. Gives examples of expressions and equations in problem solving.

3. Gives an example of operation priority in problem solving.

II. APPLICATION OF THE ACTIVITY

Engagement

At this step, the students were asked, "***Have you ever seen people around you called operators?***" and what do you think "***for example, computer operator" means***?" By asking questions, their attention is drawn and they are asked to think and discuss about this issue. By evaluating the results obtained, students' previous knowledge is evaluated and students are helped to enter a new concept by using short activities that will arouse their curiosity and provide previous knowledge. Afterwards, students are motivated by expressing that "***some of the operations performed by a computer operator can be done by themselves***", and by making the activity link between past and present learning experiences, previous concepts are revealed and students' ideas about the current activity and learning outcomes are organized.

Exploration

In this step, the students asked the question "***Have you ever heard of the concept of operator in mathematical operations***?" By asking the question, it is ensured that the existing concepts (i.e., misconceptions), processes and skills that they have with their exploratory experience are defined. In this activity, students are provided with a common activity base on which conceptual change is facilitated. A laboratory activity is performed to help students use prior knowledge to generate new ideas, explore questions and possibilities, and design and conduct preliminary research.

Explanation

In this step, after listening to the students' predictions, the concept of **operator** is explained and the **types of operators** are explained, enabling students to focus their attention on their

participation and discovery experiences, and revealing their conceptual understanding, process skills and behaviors. Ask students to demonstrate their understanding of the concept.

Elaboration

In this step, students are asked to give examples using **operators** and their conceptual understanding and skills are challenged and expanded. In addition, students are expected to apply their understanding of the concept by making additional concepts.

Evaluation

At this step, students are asked questions about which of the **Operators** are useful, and the students' ideas about where and how to use the **operators** are evaluated, and explanations are made about the points that are not understood, and the students are encouraged to evaluate their understanding and abilities.

Genişletilmiş Türkçe Özet

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Ortaokul Öğrencilerinin Yapılandırmacı Yaklaşım Yöntemi ile Bilgisayarca Düşünme, Problem Çözme Becerileri ve Araştırma-Sorgulamaya Yönelik Tutumlarının İncelenmesi

Giriş

Bilim ve teknolojide gün geçtikçe ortaya çıkan gelişmeler, birey ve toplumların öğrenme ve öğretmeye ilişkin alışkanlıklarına doğrudan etki etmiştir. Bu süreçte, bireyin bilgiyi üreten, geliştiren ve işlevsel anlamda kullanan, girişimci ve kararlı olan, topluma ve kültüre katkılar sağlayan özelliklere sahip olması beklenmektedir (MEB, 2018). İhtiyaçları ve beklentileri her geçen gün artan ve kendini yeniden şekillendirmeye çalışan bireylerdeki merak duygusu onları araştırma ve keşfetmeye yönlendirmiştir (Damar, Durmaz ve Önder, 2017). Bu çağın bireylerinin mevcut bilgiyi hemen almak yerine yeni bilgileri üretmesi ve yeni durumlara ve sorunlara uygulaması beklenmektedir (Wagner, 2008). Böylece bireyler sorunlar ile baş etmek için çaba içerisine girerek problem çözme sürecini başlatmış olurlar (Özyürek ve Begde, 2016). Problem çözme günümüz öğrencileri için gerekli olan temel bir beceridir (Kozikoğlu, 2019). Bir bireyin ne istediğini bilmesi ve bunu etkili bir şekilde ortaya çıkarması problem çözme becerisine bağlıdır (Zembat, Tunçeli ve Akşin Yavuz, 2017). Bireyin karşılaştığı herhangi bir problemin çözümünde bireysel beceriler büyük rol oynar (Özyürek ve Begde, 2016; Tümkaya ve İflazoğlu, 2000; Yılmaz ve Dost, 2016). Problem durumlarını anlamak ve çözmek bireyin bilişsel işleme girme becerisi olarak tanımlanır (Shute, Wang, Greiff, Zhao ve Moore, 2016). Problem çözme, bilişsel olduğu gibi aynı zamanda duyuşsal ve psikomotor becerileri de gerektiren karmaşık bir süreçtir (Oral, Paksoy ve Liman, 2018; Tüysüz, 2013). Problem çözme, çocuğun nasıl öğrenmesi gerektiği konusunda yardımcı olur (Ülküer, 1988). Çocukların karşılaştıkları problemleri çözmeleri için problem çözme becerilerini kazanmaları gerekir (Ekici ve Balım, 2013). Özellikle küçük yaşlarda problem çözme becerisine sahip olan bireyler yaşadıkları çevreye daha kolay uyum sağlar (Senemoğlu,

2012; Zembat ve diğerleri, 2017). Çünkü karşılaşılan problemlerin çözümünde önceki deneyimlerin katkısı bulunmaktadır (Durgun ve Önder, 2019).

İçinde bulunduğumuz çağ üst düzey bilişsel bilgi ve beceriler ile çağın gerektirdiği yetkinlikler ile donatılmış bireylerin yetiştirilmesini öngörmektedir. Bu öngörü kapsamında bireylerin adaptasyon yeteneklerinin oldukça önemli olduğu düşünülmektedir. Bireyin koşullar ne olursa olsun, ilgili koşulların dinamiklerini gözlemleyerek; ilgili duruma çok hızlı bir şekilde adapte olacak bilgi, beceri ve yeterliklere sahip olması önemlidir. Bu durumda, bilgisayarca düşünme ve problem çözme becerileri akla gelmektedir. Bilgisayarca düşünme becerisi, yaratıcılık, algoritmik düşünme, eleştirel düşünme, problem çözme ve işbirlikçi çalışma becerilerinin bir bütünü olarak ifade edilmektedir (ISTE, 2015). Bilgisayarca düşünme, bireylerin problem çözme becerilerini sistematik hale getirir ve düşünme sınırlarını genişletmelerini sağlar. Örneğin Yadav, Mayfield, Zhou, Hambrusch, and Korb (2014), bilgisayarca düşünmenin, problemleri formüle etmek ve çözümleri bilgisayar bilimleri terimleriyle ifade etmek için kullanılan ve etkili bir şekilde gerçekleştirilebilen zihinsel bir süreç olduğunu savunmaktadır. Bu zihinsel süreçleri gerçekleştiren öğrenciler, bilişim teknolojileri kavramlarını ve ilkelerini öğrenip kendilerini geliştirdiklerinde, teknoloji desteği ile günlük hayata ve kariyerlerine daha iyi hazırlanabilirler (Gülbahar, Kert, & Kalelioğlu, 2019). Bunun yanısıra araştırma sorgulamaya yönelik olarak da öğrencilerin olumlu bir tutum gleiştirmesi beklenmektedir. Çünkü tutum, davranışı harekete geçiren önemli bir faktördür (Davis, Bagozzi ve Warshaw, 1989). Bireyin kazanmış olduğu bu beceriler, içinde bulunduğu koşulları gözeterek, problemler ile baş etmesine yardımcı olabilir. Bununla birlikte, bireyin problem çözme ve bilgisayarca düşünmede bazı araştırma yöntemlerine ihtiyaç duyması da muhtemeldir. Bu hususta, araştırma-sorgulamaya yönelik olumlu tutumun geliştirilmesi de kişinin değişen ve dönüşen şartlara uyum becerisi üzerinde etkili olabilir. Bu noktada bilişim teknolojileri dersinin sahip olduğu dinamik yapısının pedagojik bir alt yapı ile bütünleştirilerek işe koşacağı düşünülmektedir. Tüm bu argümanlardan hareketle, bu çalışmada ortaokul öğrencilerinin yapılandırmacı yaklaşım ile gerçekleştirilen bilişim teknolojileri dersinin, bilgisayarca düşünme ve problem çözme becerileri ile araştırma sorgulamaya ilişkin tutumları üzerindeki etkisinin incelenmesi amaçlanmaktadır.

Yöntem

Araştırma içerisinde, ortaokul öğrencilerine yönelik yapılandırmacı yaklaşım yöntemiyle gerçekleştirilen bilişim teknolojileri dersinin bilgisayarca düşünme ve problem çözme becerileri ile araştırma sorgulamaya ilişkin tutumları üzerindeki etkisi incelenmiştir. Araştırmada, nicel araştırma yöntemlerinden olan tek grup öntest sontest modeline dayanan zayıf deneysel desen kullanılmıştır. Deneysel desenlerin içerisinde örneklem üzerinde seçkisiz atamanın yapılamadığı ve kontrol grubunun olmadığı tek gruplu desenler, bu özellikleri sağlayamamaları nedeniyle zayıf deneysel desen olarak adlandırılmaktadır (Büyüköztürk ve diğerleri, 2013).

Araştırmada çalışma grubunu, 2018-2019 eğitim-öğretim yılı, ikinci yarıyılında Kırşehir il merkezinde bir devlet ortaokulunda bulunan 14 kız 8 erkek öğrenciden oluşmaktadır. Çalışma grubunun seçilmesinde öğretim programlarında bilişim teknolojileri dersi olan ve bilgisayar düşünme becerisinin küçük yaşlarda kazandırılması gerekliliğini ortaya koyan çalışmalar (Grover, 2017; Park ve Kwon, 2022; Parmar, Lin, Dsouza ve diğerleri, 2022; Rich, Bartholomev, Daniel ve diğerleri, 2022) dayanak oluşturmaktadır.

Veri toplama sürecinde öncelikle il Milli Eğitim Müdürlüğünden gerekli izinler alındıktan sonra araştırmanın içeriğine ilişkin uygulamanın gerçekleştirileceği okulun idarecilerine, bilişim teknolojileri ders öğretmenine ve dersi alan öğrencilere bilgilendirmeler yapılmıştır. Veri toplama süreci, öğrenciler ile 2018-2019 eğitim-öğretim yılı ikinci döneminde 7 hafta boyunca gerçekleştirilen etkinlikler ile gerçekleştirilmiştir. Çalışma kapsamında gerçekleştirilen haftalık süreçler ve etkinlikler Tablo 1'de belirtilmiştir.

Tablo 1. *Çalışma kapsamında yapılan işlemler*

Hafta	Etkinlik
1. hafta	Araştırma kapsamında öğrencilere araştırmaya başlamadan öntestler uygulandı.
2. hafta	Ders planında bulunan Mantıklı Düşünüyorum Ünitesi kapsamında Bilgi - Operatörler Ve İşlem Önceliği kapsamında Operatörlerden bahsedildi. Yapılandırmacı Kuram esasında öğrencilere; 1. Daha önce "Çevrenizde kendisine operatör denen kişiler hiç gördünüz mü?" ve "Örneğin "Bilgisayar operatörü" sizce ne demektir?" soruları soruldu ve öğrencilerle bu konu hakkında tartışarak açıklanmaya çalışıldı. 2. Öğrencilere operatörleri ayırt etmeleri için akıllı tahta yardımıyla oyun oynatıldı ve operatörleri etkin bir şekilde kullanmaları istendi. 3. Öğrenciler gözlemlenerek öğrencilere merak ettikleri konularda ve takıldıkları konularda yardım edildi.
3. hafta	Ders planında bulunan Bir Algoritma Masalı kapsamında Algoritma örnekleri yapıldı. Yapılandırmacı Kuram esasında öğrencilere; 1. "Bu hikâye muhtemelen daha önce duyduğunuz bir hikâyenin biraz değiştirilmiş bir versiyonuydu. Hikâyede daha önce duymadığınız farklı bir kelime dikkatinizi çekti mi?" ve Hikâyede geçen "Algoritma" kelimesi sizde neyi çağrıştırdı?" soruları soruldu ve üzerinde tartışıldı. 2. "Algoritma Nedir?" sorusunun cevabının öğrenileceği söylendi ve Algoritma açıklandı. 3. Algoritmanın günlük yaşamda ne işe yarayacağı hakkında tartışma ortamı hazırlandı. 4. Uygulama sürecinde öğrenciler gözlemlenerek geri dönütler verildi. 5. Öğrencilerin kendi algoritmalarını yapması beklendi. Öğrenciler gözlemlenerek eksiklikleri giderildi ve geri dönütler verildi.
4. hafta	Ders planında bulunan Akışı Değiştiriyorum Ünitesi kapsamında Akış Şemaları yapıldı. Yapılandırmacı Kuram esasında öğrencilere; 1. Öğretmen elinde bulunan Akış Şeması fotoğrafının ne olduğunu soruldu. 2. Problem durumu olarak Akış Şemaları oluşturacakları söylendi. 3. "Algoritma ve Akış Şemalarının ne gibi bir bağlantısı olur?" sorusu soruldu. Öğrencilere tartışma ortamı hazırlandı.
5. hafta	Ders planında bulunan Konu olarak Blok Tabanlı Programlama kapsamında Blockly sitesinde kod blokları tanıtıldı. Yapılandırmacı Kuram esasında öğrencilere; 1. Önbilgilerini yoklamak ve üzerinde düşünmeleri için öğrencilere önceki derslerde anlatılan uygulamalar soruldu hangi kod bloklarının kullanıldığı soruldu verilen cevaplar dikkate alınarak neler yapıldığı hangi kod bloklarının ne işe yaradığı üzerinde tartışıldı. 2. Blockly sitesinde kod bloklarında dikkatlerini çeken nelerin olduğu soruldu. Alınan cevaplara göre geri dönütler verildi. 3. Uygulama esnasında öğrenciler gözlemlenerek öğrencilere geri dönütler verildi. Ve öğrencilerin sorgulama ve araştırmaları desteklendi. 4. Öğrencilerin uygulamalarını daha özgün bir şekilde ortaya koymaları desteklendi.

Tablo 1. *Çalışma kapsamında yapılan işlemler (devamı-1)*

6. hafta	Ders planında bulunan Programlama Çocuk Oyunu ünitesi kapsamında SCRATCH programı ile öğrencilere oyun yaptırıldı. Yapılandırmacı Kuram esasında öğrencilere; 1. Önceki derslerde neler işlediğimiz sorularak öğrencilerin bilgileri gözden geçirilir. Yapılan uygulamalarsa anlatılan kod bloklarına tekrardan değinilir. 2. Öğrencilere yapılacak oyun hakkında bilgiler verildi. 3. Öğrencilerin akıllı tahtada yapılan oyunun aşamalarını bilgisayarlarında aşama aşama yapmaları istendi. 4. Öğrenciler uygulamalarını yaparken gözlemlenerek öğrencilere geri dönütler verildi. Ve öğrencilerin sorgulama ve araştırmaları desteklendi. 5. Yapamayan öğrencilere yardım edildi.
7. hafta	Araştırmayı sonlandırmak ve verileri karşılaştırmak için son testler uygulandı.

Araştırmanın veri toplama sürecinde ilköğretim düzeyindeki öğrencilerin problem çözme becerilerinin ölçüldüğü Problem Çözme Envanteri (Serin, Serin ve Saygılı, 2010), ortaokul öğrencilerinin bilgisayarca düşünme becerilerinin ölçüldüğü Bilgisayarca Düşünme Beceri Düzeyleri Ölçeği (Korkmaz, Çakır ve Özden (2015) ve ortaokul öğrencilerinin araştırma-sorgulamaya yönelik tutumlarının ölçüldüğü Araştırma-Sorgulamaya Dönük Tutum Ölçeği (Ebren Ozan, Korkmaz ve Karamustafaoğlu, 2016) kullanılmıştır.

Veri toplama sürecinde kullanılan "Problem Çözme Envanteri" üç boyutla bir yapıdadır. Her bir boyut 12 maddelik problem çözme becerisine güven, 7 maddelik öz denetim ve 5 maddelik kaçınma olarak ifade edilmiştir. Açımlayıcı faktör analizi (AFA) sonucunda toplam varyansın %42.26'sını açıklamaktadır. Serin, Serin ve Saygılı (2010) tarafından geliştirilen ve ölçeğin tamamı için hesaplanan Cronbach alfa güvenirlik değeri 0.80 ve test-tekrar test güvenirlik değeri 0.85'dir. Ocak, Doğruel ve Tepe (2021)' göre Cronbach alfa değeri 0.86; Yurtseven, Akkas Baysal ve Ocak (2021)'e göre 0.85; Demir (2022)' e göre 0.80; Or ve Bal (2021)'e göre 0.83 bulunmuştur. İlgili çalışmalara göre ölçek, güncel ve güvenilir bir yapıya sahiptir. Bununla birlikte, toplam 22 maddeden oluşan "Bilgisayarca Düşünme Becerisi Ölçeği" beş boyuttan oluşan bir yapıdadır. Her bir boyut 4'er maddelik yaratıcılık, algoritmik düşünme, işbirlilik ve eleştirel düşünme; 6 maddelik problem çözme olarak ifade edilmiştir. Ölçekte güvenirlik için Cronbach alfa değeri kullanılmış olup, bu değer 0.81'dir. (Korkmaz, Çakır ve Özden 2015). Çevik ve diğerleri (2021)'e göre Cronbach alfa değeri 0.76; Özgür (2020)' e göre 0.85; Kirmit, Dönmez ve Çataltaş (2018)' e göre 0.85 bulunmuştur. İlgili çalışmalara göre ölçek, güncel ve güvenilir bir yapıya sahiptir. Son olarak, toplam 13 maddeden oluşan "Araştırma-Sorgulamaya Dönük Tutum Ölçeği" de üç boyutlu bir yapıya sahiptir. Her bir boyut 4'er maddelik "merak" ve "değer" ile 5 maddelik "kaçınma" olarak ifade edilmiştir. AFA sonucunda toplam varyansın %48.42'sini açıklamaktadır. Ölçekte güvenirlik için Cronbach alfa değeri kullanılmış olup, bu değer 0.76'dır. (Ebren Ozan, Korkmaz ve Karamustafaoğlu, 2016). Özcan (2021) Cronbach alfa güvenirlik değerini 0.80, Kozikoğlu ve Camuşçu (2019) ise 0.76 olarak bulmuştur.

Bulgular

Yapılandırmacı yaklaşım yöntemine dayalı bilişim teknolojileri dersinin ortaokul öğrencilerinin kaçınma alt boyutu üzerinde anlamlı bir etkisi olup olmadığı incelendiğinde, ortaokul öğrencilerinin kaçınma alt boyutuna yönelik öntest ve sontest puanlarının anlamlı olarak

farklılık gösterdiği gözlenmiştir. Elde edilen bulgulara göre, yapılandırmacı yaklaşım yöntemine dayalı bilişim teknolojileri dersinin kaçınma davranışlarında anlamlı olacak şekilde bir azalma (ters madde) olduğunu ortaya koymaktadır.

Yapılandırmacı yaklaşım yöntemine dayalı bilişim teknolojileri dersinin ortaokul öğrencilerinin problem çözme becerisi toplam puanı üzerinde anlamlı bir etkisi olup olmadığı incelendiğinde, öğrencilerin problem çözme becerisi ölçeği sonrası toplam puanlarına ait öntest ve sontest puanlarının anlamlı olarak farklılık gösterdiği görülmüştür. Buna göre yapılandırmacı yaklaşım yöntemine dayalı bilişim teknolojileri dersinin öğrencilerde problem çözme becerisi toplam puanına yönelik anlamlı artış oluşturduğu söylenebilir.

Yapılandırmacı yaklaşım yöntemine dayalı bilişim teknolojileri dersinin ortaokulöğrencilerinin merak duygusu alt boyutu üzerinde anlamlı bir etkisi olup olmadığı incelendiğinde, öğrencilerin merak duygusu alt boyutuna yönelik öntest-sontest puanlarının anlamlı olarak farklılık gösterdiği görülmüştür. Buna göre yapılandırmacı yaklaşım yöntemine dayalı bilişim teknolojileri dersinin öğrencilerin merak duygusu alt boyutu üzerinde pozitif yönde anlamlı bir etki oluşturduğu söylenebilir.

Yapılandırmacı yaklaşım yöntemine dayalı bilişim teknolojileri dersinin ortaokul öğrencilerinin değer alt boyutu üzerinde anlamlı bir etkisi olup olmadığı incelendiğinde, öğrencilerin değer duygusu alt boyutuna ait öntest ve sontest puanlarının pozitif yönde anlamlı olarak farklılaştığı bulunmuştur. Buna göre yapılandırmacı yaklaşım yöntemine dayalı bilişim teknolojileri dersinin öğrencilerin değer duygusu alt boyutu üzerinde pozitif yönde anlamlı bir etki oluşturduğu söylenebilir.

Yapılandırmacı yaklaşım yöntemine dayalı bilişim teknolojileri dersinin ortaokul öğrencilerinin kaçınma tutumu alt boyutu üzerinde anlamlı bir etkisinin olup olmadığı incelendiğinde, öğrencilerin kaçınma tutumu alt boyutuna ait öntest ve sontest puanlarının pozitif yönde anlamlı olarak farklılaştığı görülmektedir. Bu duruma göre yapılandırmacı yaklaşım yöntemine dayalı bilişim teknolojileri dersinin öğrencilerin kaçınma tutumu alt boyutu üzerinde pozitif yönde anlamlı bir etki oluşturduğu şeklinde ifade edilebilir.

Yapılandırmacı yaklaşım yöntemine dayalı bilişim teknolojileri dersinin ortaokul öğrencilerinin araştırma sorgulamaya yönelik tutum toplam puanı üzerinde anlamlı bir etkisinin olup olmadığı incelendiğinde, öğrencilerin araştırma sorgulamaya yönelik tutum ölçeği ile elde ettikleri toplam puana ilişkin öntest ve sontest puanlarının pozitif yönde anlamlı olarak farklılaştığı görülmektedir. Buna duruma göre yapılandırmacı yaklaşım yöntemine dayalı bilişim teknolojileri dersinin öğrencilerin araştırma sorgulamaya yönelik tutum ölçeği toplam puanı üzerinde anlamlı bir etki oluşturduğu söylenebilir.

Tartışma ve Sonuç

Sonuçlara göre ortaokul öğrencilerinin, problem çözme envanterinde yer alan kaçınma alt boyutu ve problem çözme envanterinden elde edilen toplam puanının, sontest puanlarına yönelik anlamlı farklılık gösterdiği belirlenmiştir. Alanyazın incelemeleri ile benzer ve farklı sonuçların olduğu görülmektedir. Problem çözme becerisi bir sürece dayalı çözüm bulma becerisi olarak tanımlanır (Santrock, 2011). Bir probleme ilişkin sonucu sorunun çözülmesi yerine o sorunu ötekileştirme, gerçek sorundan uzak tutma veya ilgisiz olma gibi kavramlara "kaçınma" adı

verilmiştir (Serin, Serin ve Saygılı, 2010). Araştırma sonuçlarının destekleyen çalışmalara göre; Yöyen, Azaklı, Üney, Demirci ve Merdan (2017) yaptıkları çalışma da problem çözme becerisi alt boyutu olan "yaklaşma- kaçınma" arasında pozitif yönde etkili ilişki olduğunu saptamıştır. Eğitim fakültesi öğrencileri ile yapılan başka bir çalışmada farklı branşlardaki sınıflarda problem çözme güveni ölçek değerlerinde anlamlı bir farklılık görülmemesine rağmen kaçınma değerlerinde anlamlı bir farklılık olduğu görülmüştür (Otacıoğlu, 2007). Ortaokul 7. sınıf öğrencileri ile yapılan çalışmada problem çözme ve problem çözme becerisi alt faktörü kaçınma arasında ise pozitif yönde ve zayıf düzeyde bir ilişkinin bulunduğu ifade edilmiştir (Durgun ve Önder, 2019). Saracaloğlu, Serin ve Bozkurt (2001) problem çözme becerisi envanteri açısından kaçıngan (kaçınma) yaklaşım alt boyutunda bölümlere göre anlamlı bir biçimde farklılaşma olduğunu belirtmişlerdir. Özdemir (2019) tarafından yapılan çalışmada, ergenlerin saldırganlık düzeyleri, problem çözme becerisi ve yaklaşma-kaçınma alt boyutu arasında anlamlı ilişkilerin bulunduğu belirlenmiştir.

Bu çalışmada ortaokul öğrencilerinin araştırma sorgulamaya dönük tutum ölçeğinden elde ettikleri toplam puan ile merak, değer ve kaçınma tutumu alt boyutları arasında bulunan anlamlı farklılığın da sontest puanına yönelik olduğu görülmüştür. Bu çalışmayı destekleyen çalışmalar incelendiğinde, Saraçoğlu ve Kahyaoğlu (2018) ortaokul öğrencilerine ait bilimsel sorgulama becerisi algıları ile Fen Bilimleri dersine ilişkin merak, motivasyon ve tutumlar arasındaki ilişkide pozitif düzeyde anlamlı ilişkinin bulunduğunu ifade etmişlerdir. Başka bir çalışmada ortaokul öğrencilerinin araştırma ve sorgulamaya ilişkin tutumları ile ters yüz öğrenme düzeyleri arasında orta düzeyde, pozitif yönde anlamlı ilişkinin ortaya çıktığı belirlenmiştir (Kozikoğlu ve Camuşcu, 2019). Ozan ve Karamustafaoğlu, (2020) ortaokul öğrencilerine araştırma ve sorgulama becerileri kazandırılmasına ilişkin gerçekleştirdikleri çalışmada, değer verme ve kaçınma becerilerinin deney grubunun her iki beceri için ortalamanın yükseldiğini ve deney grubu lehine pozitif yönde farklılık olduğunu ifade etmişlerdir.

Sonuçlar incelendiğinde, öğrencilerin bilgisayarca düşünme becerilerinin artmasında öğrencilere sağlanan teknolojik ortamın, materyallerin ve çok sayıda gerçekleştirilecek uygulamaların önemli derecede etkilerinin olabileceği düşünülmektedir. Bilgisayarca düşünme, öğrencilerin problem çözme becerilerini geliştirerek süreç içerisinde verimliliklerini artırır (ISTE, 2015). Bilgisayarca düşünme, teknolojinin kullanımı ile problem çözme becerilerinin artırılmasında yaratıcılık ile eleştirel düşünme vb. becerileri ortaya çıkarmayı hedefler (Oluk, Korkmaz ve Oluk, 2018). Süreç içerisinde gerçekleştirilen kodlama uygulamaları, mantıksal-analitik ve algoritmik düşünme, problem çözümüne ilişkin yaklaşımlar kazandırabilir (Pala ve Mıhcı-Türker, 2019). Kodlama eğitimlerinin küçük yaşlardaki öğrencilik hayatında gerçekleştirilmesi, öğrencilerin gelişimlerine yönelik etkili kazanımlar meydana getirecektir (Akdoğan, 2020).

Öneriler

Bu çalışma temele aldığı yöntem ve katılımcılar ile sınırlıdır. Gelecek çalışmalarda öğrencilerin görüşlerine başvurularak elde edilen sonuçların derinlemesine yorumlanması söz konusu olabilir. Ayrıca, problem çözme becerisi, bilgisayarca düşünme ve araştırma-sorgulamaya yönelik tutum değişkenlerinin entegre bir model çerçevesindeki doğrudan ve dolaylı etkilerini ortaya koyan bir çalışma yapılabilir. Bununla birlikte, temel alınan yöntemin etkisi kalıcılık testi

ile ölçülerek veya nitel bir çalışma ile de desteklenerek; elde edilen anlamlı farklılıklara ilişkin güçlü ve zayıf hususlar ortaya konulabilir. Böylelikle, çalışma kapsamında yapılan deneysel işlemde bilgisayarca düşünme değişkeni ve alt boyutlarında elde edilen sonucun bilimsel olarak daha kapsamlı bir şekilde açıklanması söz konusu olabilir. Son olarak, gelecek çalışmalarda deneysel işlem süreci daha uzun planlanabilir, 5E yapılandırmacı yaklaşım temelinde gerçekleştirilen bu çalışma psiko-motor ve duyuşsal alan kazanımları ile zenginleştirilmiş bireysel ve grup çalışması uygulamaları ile genişletilebilir.