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Research Article

Algorithm-based mathematics from the perspective of gifted students: A case study [1]

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Abstract

An algorithm in mathematics is the design of a simple, clear, and specific order of the way to solve a problem. Designing an algorithm in accordance with the rules on the solution of a well-defined sample problem will enable students to consciously manage their own learning processes in solving the problem. The study aims to prepare algorithmic activities in accordance with the learning outcomes of the 4th-grade mathematics curriculum and to obtain the opinions of gifted students about these activities. The research was conducted using a case study design, one of the qualitative research designs. The study group consisted of 17 students studying at the 4th grade level of Science and Art Centre (SAC) in Afyonkarahisar province located in the west of Turkiye. The algorithmic activities were prepared with Lucidchart, a Web 2.0 tool that can prepare algorithms in a digital environment. In order to obtain the students' opinions about the activities carried out, a semi-structured interview form was prepared. The students were interviewed before and after the implementation of the activities. In the interview form, students' knowledge levels about algorithms were analyzed with Wilcoxon Signed Rank test. Students' algorithmic thinking awareness and their views on algorithm-based mathematics activities were analyzed by content analysis. As a result of the data analysis, while the students' knowledge level of the algorithm was low before the application, it increased to a high level after the application and revealed a significant difference. Accordingly, students were able to explain algorithmic thinking skills by producing many codes (rhythmic counting, calculating each path, Lego, experiment, artificial intelligence, instruction, etc.). The use of algorithms in mathematical activities was found to be fun, instructive, facilitating, interesting, revealing of prior knowledge, endearing, and a guide to mathematics. On the other hand, the use of algorithms was found to be tiring and boring due to its limitations in terms of step-by-step progress and immediate achievement of the result. The use of algorithms in mathematics teaching can improve students' algorithmic thinking skills and contribute to the development of their mathematical skills. In addition, it is suggested that these activities should be disseminated through the use of Web 2.0 tools.

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Introduction

Learning mathematics is a fundamental life skill. Like literacy, mathematical skills are involved in every aspect of our lives. Today, when technology is at the center of our lives, students need to use several skills effectively, such as structuring, modifying, communicating or integrating new information in different ways. Solving new problems and

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approaching new situations from a mathematical perspective should be as natural as using literacy to understand facts, insights, or information. In some cases, acquiring the mental tools to understand mathematics in as-yet-unknown mathematical applications is crucial for interpreting our environment and surviving successfully (Van de Walle, Karp, & Bay-Williams, 2021).

In today's education system, instead of filling students' minds with information that they may never use in their lives and will forget after some time (Umay, 2003; Yildirim, 2018), it is necessary to engage students' minds with skills such as problem-solving, establishing relationships, reasoning, and expressing their thoughts. Individuals should be made aware that mathematics is part of life, not operations and rules, and every learning opportunity should be used to develop mathematical thinking (Ministry of National Education [MoNE], 2018).

In mathematics lessons, some procedures and shortcuts that do not encourage students' thinking are directly given, and students are asked to memorize this information. However, students should be given opportunities (The Scientific and Technical Research Council of Turkiye [STRCT], 2022) to think about the subject, talk about it, create models, and give meaning to mathematics. The inclusion of activities in which students can easily express their own thinking and reasoning processes and see the shortcomings or gaps in others' mathematical reasoning processes will enable them to consciously manage their learning processes (MoNE, 2018). Thanks to these activities, mathematics becomes meaningful for students, and they will not have to memorize mathematical procedures.

Mathematics is based on concepts and operations with a certain order and a logical sequence. One of the basic elements of meaningful mathematics for students is to discover this order. It is very important to prepare environments that will allow students to see and create meaningful mathematical relationships (Karakus & Baki, 2020). One of the applications that will be used for the creation of these environments is algorithm-based applications. For the majority of people, the word algorithm is known to be something that is related to computer science (Hubalovsky & Korinek, 2015; Mayer, 1981). However, in computer science and in all areas of life, algorithms are used as a set of rules that govern a decision-making process (Bundy, 2007). For example, when you are preparing a meal, the steps in the recipe for that meal are, in fact, an algorithm (Atabay, 2019). Algorithm-based actions at every stage of our lives develop our systematic thinking skills and our algorithmic thinking skills. Algorithmic thinking is understanding, applying, producing, and evaluating algorithms (Brown, 2015). Algorithmic thinking is an important skill that should be emphasized because it is the basis of many actions, such as problem-solving, system design, and program development, from everyday skills such as describing places, understanding human behavior, and serving people (Copur, 2020). Therefore, considering that algorithms surround us, it can be concluded that the development of algorithmic thinking skills in individuals is an important achievement (Korkmaz et al., 2015).

Algorithmic thinking is not just a way of thinking related to computers. Algorithmic thinking is considered to be a way of thinking that is related to problem-solving (Aho, 2012; Wing, 2006). Algorithmic thinking refers to the systematic understanding of problem situations and the finding of generalizable solutions for problem-solving (Guler, 2021). In the current era of information and communication technologies, algorithmic thinking skills are considered an important prerequisite for the development of effective problem-solving skills and the use of information and communication technologies (Galezer et al., 1995). Teachers' beliefs, perceptions, and attitudes toward algorithmic thinking have an impact on both their algorithmic thinking practices and teaching approaches (Kordaki, 2013). Therefore, teachers should both have algorithmic thinking skills and should guide students in the development of algorithmic thinking skills (Guler, 2021). In addition, the inclusion of algorithmic thinking education in curricula at all levels of education is important (Papadakis & Kalogiannakis, 2019).

An algorithm in mathematics is the design of a simple, clear, and specific sequence of operations for the solution of a problem. For example, you must first perform the operation (3+5) and then the operation "result/2" if you want to find the average of the numbers 3 and 5. In an algorithm, where the steps in a logical sequence are designed to solve a particular problem, each step must be designed very carefully and must be terminated after a certain number of steps have been completed. The designed algorithms can be visualized, explained, and applied to the computer with the help of a programming language (STRCT, 2022) by transferring them to the flowchart if desired. In the flowchart, different geometric shapes are used. The ellipse shows the place where the algorithm starts and ends. The parallelogram shows the data input from outside. The rectangle shows the operations, and the diamond shows the place where the decision or comparison is made (Guven, 2018). These shapes are universal. They make the algorithm more objective and understandable. Since students with visual intelligence express their thoughts more easily with shapes and symbols, they understand the logic of the algorithm better with the flowchart (Talu, 1999). Designing an algorithm to solve a well-defined sample problem according to the rules, considering all possibilities, and showing the designed algorithm with sequential logical steps with a flowchart enables students to consciously manage their own learning processes in solving the problem (MoNE, 2018; STRCT, 2022). Therefore, preparing algorithmic activities in solving mathematical activities will contribute to the development of students' algorithmic thinking skills and problem-solving skills.

In reviewing the studies conducted in the literature, it was found that there is a significant relationship between algorithm success and problem-solving skills (Demir & Cevahir, 2020). It was found that students were more successful in problem-solving on the basis of a standard algorithm than in problem-solving on the basis of a non-standard algorithm (Topal, 2015). The application of activity-based algorithms supports the problem-solving skills of children aged 5-6 years (Kucukkara, 2019). It was found that sixth-grade students were successful in developing fractional algorithms (Yildirim, 2019). It was found that developing and playing games at the pre-school, primary, and secondary school levels, as well as coding training with Scratch, positively influenced students' algorithmic thinking skills (Atabay, 2019; Dogan & Kert, 2016; Hsu & Wang, 2018; Oluk et al., 2018; Yildiz, 2020; Yunkul et al., 2017). A study with pre-service teachers concluded that the level of logical and mathematical intelligence of students has a positive effect on their algorithm development skills (Korkmaz, 2012). It has been observed that programming instruction in the context of mathematics is effective on students' mathematics self-efficacy (Psycharis & Kallia, 2017). An elective course called algorithmic thinking has been designed for prospective teachers of computer science, and it has been found to be effective and useful (Guler, 2021). As can be understood, it can be seen that algorithmic studies are included in different educational levels, from the pre-school education level to the higher education level. However, no study was found in which gifted students were included in the study group. Gifted students are special individuals with higher mental, social, and creative abilities than their peers (Ataman, 2000). Students who are gifted in mathematics stand out as individuals who can make analogies and develop independent, original, and creative solutions to mathematical problems by reasoning (Polya, 1962). Miller (1990) states that these individuals have an unusual curiosity for mathematical knowledge and can bring different, flexible, and creative solutions to problems other than the learned ones. Krutetskii (1976) stated that people with special abilities in mathematics can use the reasoning process by comprehending the complex structures of problems and simplifying complex processing systems. Gardner (2011) mentions that people with this area of intelligence can focus on structures that can develop generalizations rather than performing numerical operations and have developed the ability to form rules for significant concepts. According to Sriraman (2005), individuals gifted in mathematics have highly developed skills in organizing data, logical thinking, analytical and holistic thinking, problem-solving and construction skills, the ability to form problems and relationships in their minds, and the ability to think repeatedly. Therefore, the use of algorithms in creating and solving a mathematical problem will focus on the analytical and holistic thinking skills of gifted individuals and allow them to look from a broad perspective. Because creating the algorithm steps of the solution steps of a mathematical problem in students' minds, writing them down without skipping the steps, and checking whether this process works or not, will contribute to supporting them by improving their ability to organize data and information. Therefore, the superior characteristics of these individuals should be revealed and supported (Fernández et al., 2017; Navas-Sánchez et al., 2016; Pfeifer, 2012; Renzulli, 2012). In Turkiye, in order to support gifted students, enriched and differentiated educational content is provided through science and arts centers (SAC). In these centers, gifted students receive education under the guidance of expert teachers at certain times of the day so as not to interrupt their education at school to recognize and develop their interests and talents. Students in 1st, 2nd, and 3rd grade are entitled to enroll in SACs when they succeed in art, music, and general mental ability exams. In these centers, Adaptation, Support Education, Individual Talents Awareness (ITA), Special Talents Development (SAD), and Project Production/Management programs are carried out, respectively. The Support Education Program is the education program that primary school students identified in the field of general intellectual ability continue after the Adaptation Program. This program aims to improve communication, cooperation, group work, learning to learn, problem-solving, scientific research, entrepreneurship, critical and creative thinking, effective decision-making, technology literacy, social responsibility, and effective use of resources. Classroom teachers, the implementers of the Support Education Program, carry out activities with different sub-themes in four modules each year and transition students to the next program. In addition, the educational situation dimension of the SAC curriculum states that teachers and students can establish content-rich learning experiences (MoNE, 2021). In the development of these students' mathematical skills, it was stated that teaching should be carried out with teaching methods and strategies that can provide them with positive learning experiences (Ozlu-Unlu et al., 2022).

Problem of Study

In this study, the aim was to integrate algorithms into gifted students' mathematical activities to provide them with a different learning experience. In this context, the opinions of the students of the 4-grade who attend the Science and Art Centre on algorithms and algorithm-based mathematics activities were investigated. The aim of this study is to prepare algorithm-based mathematics activities in accordance with the acquisitions in the 4th-grade mathematics curriculum and to obtain the opinions of 4th-grade SAC students about these activities. The questions of the research were formed as follows: For 4th-grade SAC students;

- What is their level of knowledge about the algorithm?
- What is their awareness of algorithmic thinking?
- What are their opinions on algorithm-based mathematics activities?

Method

Research Model

A case study, one of the qualitative research designs, was used to conduct the research. According to Creswell (2007), a case study is a research approach that analyses one or more situations in depth using data collection tools such as observations, interviews, reports, and related themes. A case study is a design that deeply investigates one or more events, environments, programs, social groups, or other related systems (McMillan, 2000). This study was an in-depth analysis of students' opinions about algorithms and algorithmic mathematics activities. In this context, interviews were conducted with 17 4th grade SAC students before and after the activities.

Study Group

The research was carried out with 17 students who are studying at the level of 4th grade in the field of general ability in a science and art center in the province of Afyonkarahisar in the 2021-2022 academic year. The study group the research was formed according to the convenience sampling method. Convenience sampling is one of the purposive sampling methods (Yildirim & Simsek, 2006). In convenience sampling, situations, where the researcher has easy access to the study group are preferred (McMillan & Schumacher, 2014). In this context, the researcher, who was a classroom teacher at SAC at the time, included 17 students who were taking the course as part of remedial education in the study group. Information about the students in the study group is presented in Table 1.

Table 1. Structures of participants and codes

No	Grade	Program	Gender	Age	Code
1	4th	Support Training	Female	9	S1-F-9
2	4th	Support Training	Male	9	S2-M-9
3	4th	Support Training	Male	9	S3-M-9
4	4th	Support Training	Female	9	S4-F-9
5	4th	Support Training	Male	9	S5-M-9
6	4th	Support Training	Female	9	S6-F-9
7	4th	Support Training	Female	9	S7-F-9
8	4th	Support Training	Female	9	S8-F-9
9	4th	Support Training	Male	9	S9-M-9
10	4th	Support Training	Female	9	S10-F-9
11	4th	Support Training	Male	9	S11-M-9
12	4th	Support Training	Male	9	S12-M-9
13	4th	Support Training	Female	9	S13-F-9
14	4th	Support Training	Female	9	S14-F-9
15	4th	Support Training	Female	9	S15-F-9
16	4th	Support Training	Female	9	S16-F-9
17	4th	Support Training	Female	9	S17-F-9

Table 1 shows that all 17 students who participated in the study were enrolled in the support program at the 4th-grade level and were in the same age group (9 years old). Six students were female (35.3%), and eleven were male (64.7%). The students were coded as participant number, gender, and age (S1-F-9).

Data Collection

The students who participated in the study were interviewed both before and after the application process. The interview is a mutual and interactive data collection process based on the asking and answering of questions for a predetermined and serious purpose (Yildirim & Simsek, 2006). For the interviews, a semi-structured interview form was prepared, which included three questions. During the interview, the students were asked to give an example of mathematical activity and to explain in detail their opinion about the activity. It took the students 15-20 minutes to answer the questions in the form in the pre-interview and 25-30 minutes in the post-interview. In preparing the interview form, the expert opinion of a faculty member of the teaching staff working in the field was sought. The following questions were included in the form.

1. About the algorithm;

( ) I have no knowledge.

( ) I have a low level of knowledge.

( ) I have a medium level of knowledge.

( ) I have quite a lot of knowledge.

( ) I have a high level of knowledge.

2. Write what comes to your mind when you think of algorithmic thinking skills.

3. What are your opinions about the use of algorithmic content in mathematics lessons?

Implementation process

The study was completed in 4 weeks within the scope of Support Education. In the first week, the researcher applied the interview form before the activities to get the opinions of the students. The third question in the form was asked only in the last interview after the students gained knowledge and experience about algorithms and prepared mathematical activities using flowcharts. After the students answered the first two questions in the interview form, a video was shown to them so they could comprehend what an algorithm meant (Kodla & Oyna, 2022). Then, the students were told what the stages of the algorithm are, what the flowchart and the shapes to be used in the diagram mean, and examples from daily life were presented. Information about the shapes used in the flowchart is presented in Figure 1.

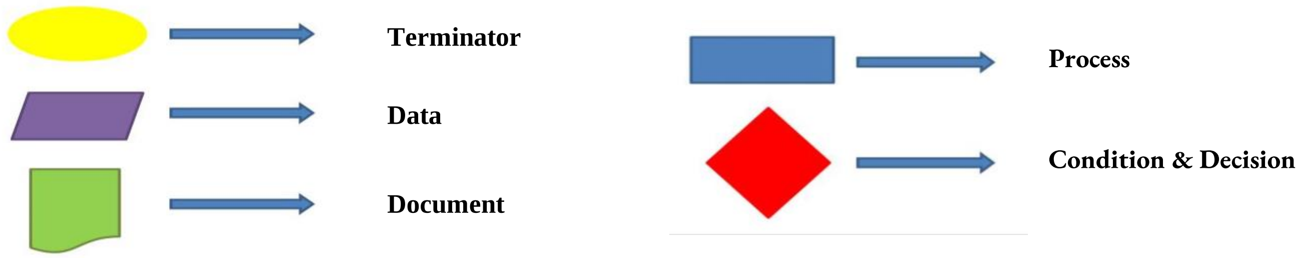
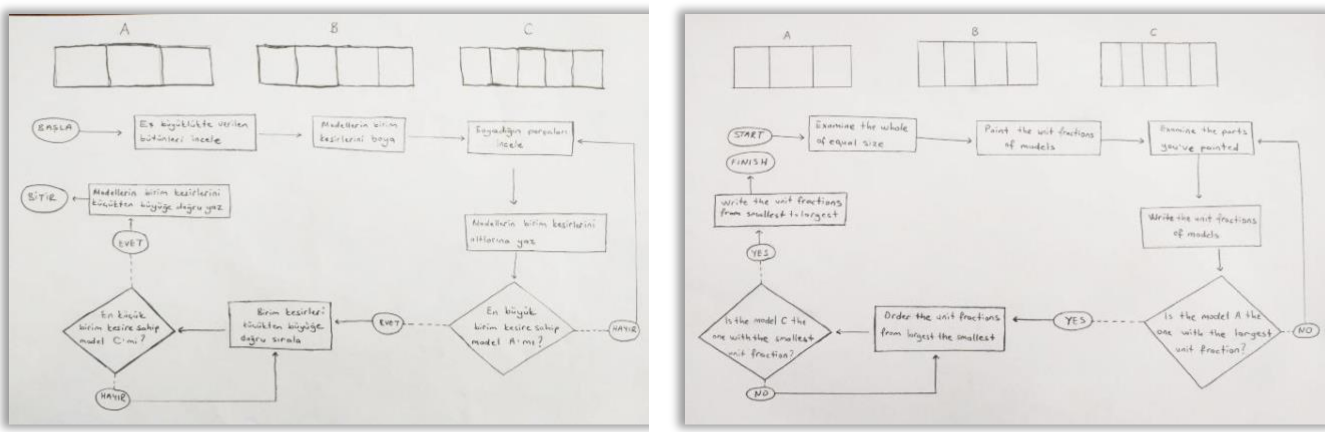


Figure 1. Figures Used in the Flowchart and Their Meanings

Figure 1 shows the shapes used in the flowchart while preparing the algorithm and what these shapes mean. In the flowchart, the ellipse starts and ends the algorithm. Parallelogram is used when a variable is entered from outside, a rectangle is used for calculation, and a rhombus is used for decision-making or comparison. Document shape is used for output. After these explanations, an algorithmic activity was prepared on the smart board with the students as an example.

In the second week, how to prepare an algorithmic activity suitable for the mathematics outcome was explained, and an example was presented (Figure 2). The students were also asked to prepare an algorithmic activity using the mathematics outcome on paper and then make a presentation. During the presentation, it was checked whether the flowchart was started correctly, whether the figures were used in accordance with their meanings, whether they fully guided the mathematical operations, and whether the result was reached. The following week, each student was given different mathematical outcomes to prepare and present algorithmic activities on paper. The students presented the activities they prepared one week later and evaluated them by considering the flowchart features and the mathematical outcomes.



Turkish English

Figure 2. A sample algorithmic activity prepared in accordance with the mathematics outcome

In the third week, Lucidchart, one of the Web 2.0 tools that can be used to create flowcharts, was introduced to the students. Lucidchart is a Web 2.0 tool that can easily create fun flowcharts. Algorithms can be created by logging into this Web 2.0 tool free of charge with an e-mail account. How to log in to Lucidchart Web 2.0 tool and how to prepare algorithmic activities were shown step by step on the smart board. After completing this task, a sample digital algorithmic activity was prepared, and students were asked to prepare and present algorithmic activities with this Web 2.0 tool. The students prepared their own algorithmic activities in the digital environment at home and made their presentations one week later (Figure 3). The other students also evaluated the presentations according to the features of the flowchart and their suitability to the mathematics objectives. In this way, the activities were completed with a total of 28 mathematics objectives in 4 weeks. These objectives cover the learning areas of Natural Numbers (6 objectives), Addition with Natural Numbers (4 objectives), Subtraction with Natural Numbers (4 objectives), Multiplication with Natural Numbers (6 objectives), and Division with Natural Numbers (8 objectives). After the implementation, the interview form was filled in again, and the process was completed.

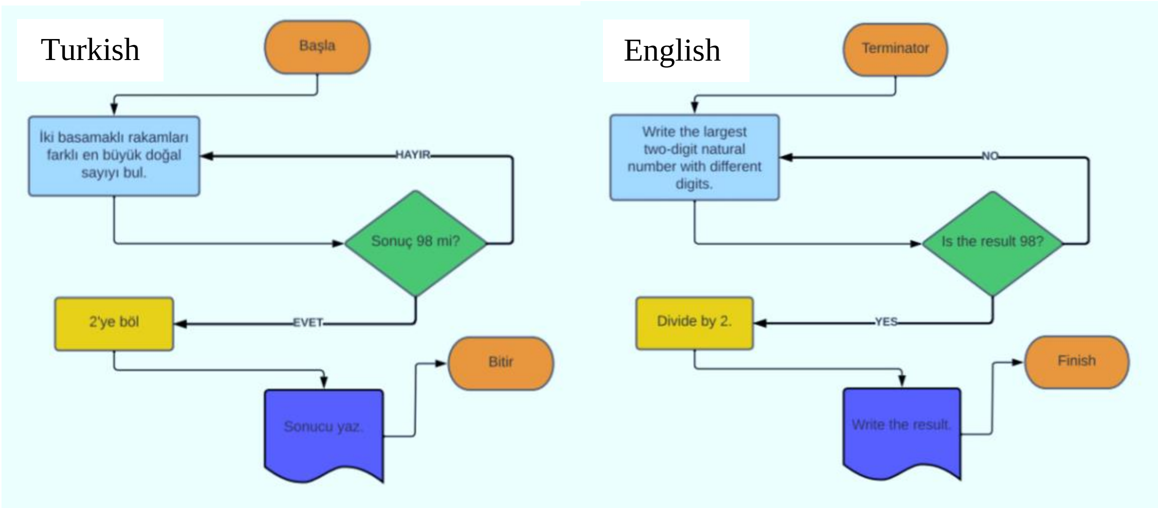


Figure 3. Sample Algorithmic Activities Prepared with Lucidchart

Data Analysis

In analyzing the first question in the interview form, the student's scores were first calculated using the criteria in Table 2 to determine the student's knowledge levels.

Table 2. Scores and information levels

Score	Scale Limits	Description
5	4.51-5.00	Highest
4	3.51-4.50	High
3	2.51-3.50	Moderate
2	1.51-2.50	Low
1	1.00-1.50	Lowest

According to Table 2, student's level of knowledge about algorithms was scored from 1 to 5. Before the application, 12 students scored 1 point, 3 scored 2 points, and 2 scored 3 points. After the application, 9 students received 3 points, 5 received 4 points, and 3 received 5 points. According to this score distribution, 12 students had the lowest level, 3 students had a low level, and 2 students had a medium level of knowledge about the algorithm before the application. After the application, 9 students reached the medium level, 5 reached the high level, and 3 reached the highest level of knowledge. Using these scoring criteria, the minimum and maximum values, averages, standard deviations, and Shapiro-Wilk test results of the scores obtained by the students before and after the application was calculated. The results of the descriptive statistics values obtained are shown in Table 3.

Table 3. Results of descriptive statistics

Application	n	Min	Max	*M*	sd	Shapiro-Wilk		
						Statistic	df	Sig.
Pre-application	17	1.00	3.00	1.41	0.71	0.62	17	0.00
Post-application	17	3.00	5.00	3.64	0.78	0.75	17	0.00

p>.05

In Table 3, the lowest score of the students before the application was 1 and the maximum score was 3. After the application, the lowest score was 3, and the highest score was 5. The average score before the application was 1.41, and the average score after the application was 3.64. According to the average score before the application, the student's level of knowledge about the algorithm was at the lowest level. In contrast, their level of knowledge increased to a high level after the application. Wilcoxon Signed Ranks test was used to determine whether this differentiation was significant. The results of the Shapiro-Wilk test calculated for the pre-and post-application data were analyzed using this test. According to these results, significance values less than 0.05 indicate that the data do not meet the normality condition (Can, 2019). Therefore, it was assumed that the data were not normally distributed, and the Wilcoxon Signed Ranks test, one of the nonparametric tests, was used.

The qualitative data of the second and third questions were analyzed by content analysis. Content analysis is used to reduce qualitative data and to make logical inferences from qualitative data. In content analysis, the basic meanings of the data are tried to be determined (Patton, 2002; Yildirim & Simsek, 2006). The answers to the second and third questions were collected under categories and presented in tables so the reader could understand better.

Ethical Approval

Ethical approval was obtained from Afyon Kocatepe University Social and Human Sciences Scientific Research and Publication Ethics Committee (Decision Date: 13.05.2022, Decision Number: 2022/161).

Procedure

The application was carried out in the spring semester of the 2021-2022 academic year by the researcher, a classroom teacher at SAC. Before starting the application, the activity plans to be used in the activities were ready, and the researcher applied the interview form. The purpose and instructions of the form were explained to the students before the application. It was stated that the form was not an exam, but the results would be used for a scientific study. After completing the form, the activities were started. Information about the activities implemented is presented in Table 4.

Table 4. Information about the applied activities

Activity Name	Duration	Outcomes	Explanations
Getting to Know the Algorithm	4 class hours	- Creates an algorithm in accordance with the sequence of events in the text he/she listens to/watches. - Understands the logic of the algorithm. - Gives examples suitable for the definition of the algorithm.	It is explained what an algorithm is. Flowcharts and figures are introduced. Examples from daily life are presented.
Algorithm of a Problem	4 class hours	- Understands the logic of the algorithm. - Creates an algorithm for solving a problem. - Applies the algorithm steps according to the given instruction.	An algorithm for solving a mathematical problem is prepared and shown in a flowchart. Prepared algorithms are presented.
Digital Algorithm	4 class hours	- Creates an algorithm for solving a problem. - Applies appropriate instructions to the algorithm.	Digital algorithm preparation tools are introduced. Algorithms are prepared in the digital environment to solve mathematical problems. Prepared algorithms are presented.
My Digital Algorithm	4 class hours	- Creates an algorithm for solving a problem. - Performs commands according to the given algorithm.	Digital algorithms are prepared for solving a mathematical problem. Prepared algorithms are presented.

Table 4 shows information about the four different activities applied. The activities were applied to the support education program students in accordance with the learning outcomes determined in four class hours each week.

Visuals of these activities are given below. A sample activity plan is given in Appendix 1.

Figure 4. Algorithm Studies suitable for mathematics outcomes

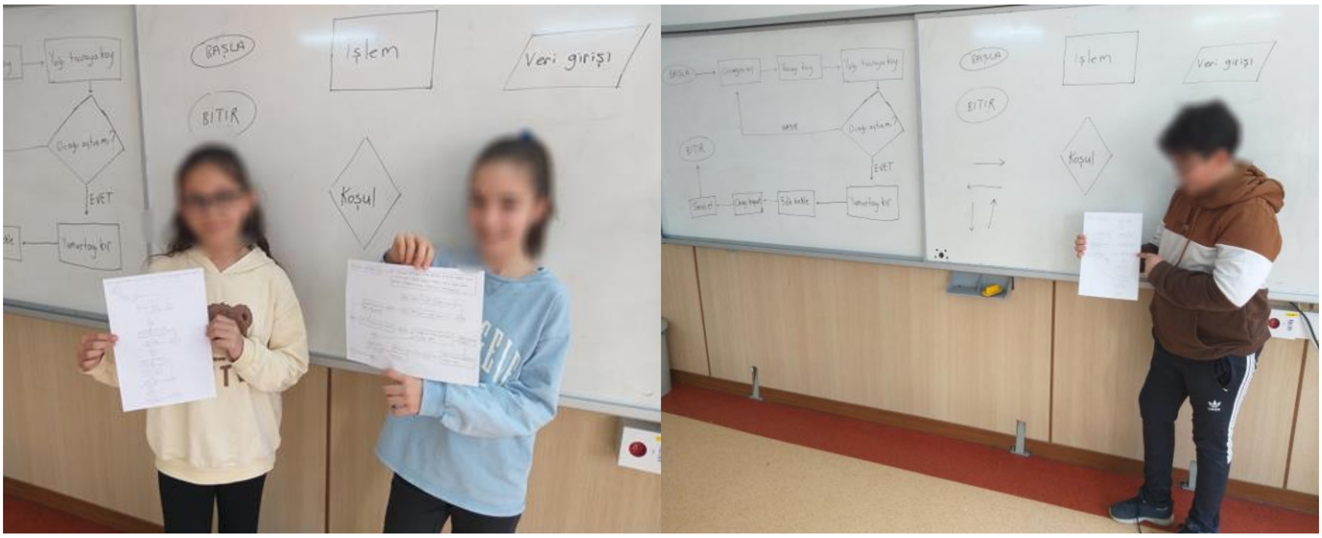


Figure 5. Presentations of algorithm activities prepared in accordance with mathematics outcomes

Results

This section presents the results of the Wilcoxon Signed Ranks test and content analysis obtained from gifted students.

Findings Related to Algorithm Knowledge Levels of Gifted Students

The first sub-problem of the research is to determine whether the knowledge levels of 4th-grade SAC students about algorithms differ significantly. In order to find an answer to this sub-problem, the Wilcoxon Signed Ranks test results conducted to analyze the students' scores before and after the application are presented in Table 5.

Table 5. Analysis of students' algorithm knowledge level scores before and after the application

Pre-application - Post-application	n	Mean rank	Sum of ranks	*z*	*p*
Negative	0[a]	0.00	0.00		
Positive	17[b]	9	153	-3.714	0.000*
Equal	0[c]				

p<.05

Table 5 shows a significant difference between students' scores before and after the application (z=-3.714, p<0.05). This finding shows that the activities increased the students' level of knowledge about algorithms. This increase was from the lowest level before the application (*M*=1.41) to the highest level after the application (*M*=3.64).

Findings Related to Algorithmic Thinking Awareness of Gifted Students

The second sub-problem of the research is to determine the awareness of 4th grade SAC students about algorithmic thinking. In order to answer this sub-problem, the data obtained before the application are presented in Table 6, and the data obtained after the application are presented in Table 7.

Table 6. Content analysis of students' awareness of algorithmic thinking before the application

Category	Code	f
Lowest	Organized thinking, thinking, visualization, imagination, organizing things, maps, science	7
Low	Higher level thinking, thinking in order, brain, robotic coding, arduino	5
Moderate	To plan, to think of all the ways to do things in order	3
High	-	-
Highest	-	-

In Table 6, in the category of "Lowest" students produced 7 codes (Organized thinking, thinking, visualization, imagination, organizing things, maps, science). In the "Low" category, students produced 5 codes (higher level thinking, thinking in order, brain, robotic coding, Arduino). In the category of "Moderate", students produced 3 codes (To plan, to think of all the ways, and to do things in order). This finding shows that students have limited knowledge about what algorithmic thinking skill is and where it is used.

Table 7. Content analysis of students' awareness of algorithmic thinking after the application

Category	Code	f
Lowest	-	-
Low	-	-
Moderate	How the computer works, what we do in daily life, work done in sequence, puzzle (2), Action done in sequence (3), telling in rhythmic order, doing step by step (3), rhythmic counting (2), calculating every path, Lego, experiment, spicy Turkish omelet, problem-solving, instruction, coding, software, robots, games	25
High	Command, robot (2), being able to do a job, detailed concepts, program, puzzle (2), Artificial intelligence, performing operations in order, rhythmic counting, step-by-step, Orientation, form	14
Highest	Algorithm steps, doing regular and planned work (2), computer programming	4

In Table 7, students produced 25 codes (rhythmic counting, calculating every path, Lego, experiment, spicy Turkish omelet, problem-solving, coding, etc.) in the category of "Moderate," 14 codes (command, robot, artificial intelligence performing operations in order, etc.) in the category of "High" and 4 codes (algorithm steps, doing regular and planned work, computer programming) in the category of "Highest" The increase in the variety and number of codes produced in the last interview data show that the student's awareness of algorithmic thinking has been formed due to the activities carried out and that they understand what it is used for.

Findings Regarding the Opinions of Gifted Students on Algorithm-Based Mathematics Activities

The third sub-problem of the research is to determine the opinions of 4th-grade SAC students about algorithm-based mathematics activities. In order to find an answer to this sub-problem, the findings of the answers given by the students to the last question in the interview form are presented in Table 4.

Table 8. Content analysis of students' opinions on algorithm-based mathematics activities after the application

Category	Code	f
Lowest	-	-
Low	-	-
Moderate	Fun (4) Instructive (3) Made it easier for us to do operations (3) My interest in the lesson increased (3) Revealed our previous knowledge Tiring Boring (2)	17
High	Fun (3) Instructive (3) Made it easy for us to do operations Made us love the math class Tiring Boring (3)	12
Highest	Fun (3) Orientation (2) It made it easier for us to make transactions	6

In Table 8, students with a moderate level of knowledge put forward 17 different views under 7 different codes and found the algorithmic activities fun, instructive, facilitating interesting and revealing preliminary knowledge. However, there are also students who say that these activities are tiring and boring. In this category, the student expressions that reveal the opinion that is entertaining, instructive, facilitating, interesting, and revealing preliminary information are presented below:

S4-F-9: I think it is very ***fun****. Normal maths lessons are very boring. I was bored at first, but as the activities progressed step by step and I solved the questions, I had a lot of fun.*

S1-F-9: The algorithm helps me understand the operations more clearly. We are used to solving normal tests. This activity was a new ***experience****.*

S6-F-9: Performing operations with an algorithm ***makes it easier*** *to solve the problem.*

S9-M-9: I was very surprised, and it was very ***interesting*** *that the algorithm used in every stage of life was also used in the mathematics lesson.*

S16-F-9: It was different and beautiful. We solved the question using our ***previous knowledge.***

Students with high level of knowledge reported 12 different opinions under 6 different codes and found algorithmic activities fun, instructive, facilitating, and endearing. There were also students who found these activities tiring and boring. In this category, the statements of the students who found the mathematics lesson endearing, tiring, and boring are presented below:

S13-F-9: Since it is a different activity, it can be the favorite lesson in the class. If I had this course at school, it would be ***my favorite*** *course.*

S10-F-9: It would be useful, but some algorithms are very ***tiring****. It never ends. When you can't do it, you start over again.*

*S12-M-9: The algorithm suits mathematics, but going step by step was a bit **boring**. You want to reach the result immediately, but you can't.*

Students with a highest level of knowledge expressed 6 different opinions under 3 different codes and explained that algorithmic activities are fun, guiding, and facilitating. In this category, student expressions reveal the opinions of fun, orientation, and facilitating are presented below:

*S9-M-9: Mathematics does not give us activities, but we learn in a **fun** way with algorithms.*

*S17-F-9: Solving questions like this is both practical and easy as it **orients** us.*

*S5-M-9: It makes the operations more understandable and **helps** me solve problems I had difficulty solving before.*

Conclusion and Discussion

The students' knowledge levels of algorithms significantly differentiated from the lowest level before the application to the highest level after the application. This result shows that most of the students did not know algorithms before. However, with the activities carried out after the application, the student's knowledge of the algorithm increased. We can say that the preparation and presentation of algorithms first on paper and then in a computer environment with the Lucidchart Web 2.0 tool in accordance with the mathematics achievements were effective in this result. While preparing these activities, the figures' meanings in the flowchart were considered; algorithm steps were applied to solve mathematical expressions and problems. In this way, students both gained knowledge about algorithms and different experiences in developing mathematical skills. Different learning experiences in developing mathematical skills and integrating today's technology into mathematics lessons are considered important in supporting the development of gifted students (Karakus & Baki, 2020; Komarudin et al., 2020). Similarly, the results that STEM activities contribute to the creative thinking skills (Kucuk Demir & Duzen Karatepe, 2022) and problem-posing skills (Yurtbakan & Aydogdu-Iskenderoglu, 2023) of gifted students show the need for different learning experiences in supporting gifted students. In addition, differentiated instructional design for value education increased the value development of gifted students; students were happy both to learn values and to create technology-supported products (Avcu & Yaman, 2022). In parallel with the results of these studies, providing differentiated learning experiences and integrating technology into learning activities can be considered an important result in terms of supporting gifted students. In the 21st century, the use of technology in education is considered important to make learning activities motivating, fun, and interesting (Hamdaoui et al., 2015; Yi & Mogilski, 2015). In this study, the preparation of algorithms with the Lucidchart Web 2.0 tool and the fact that the figures used in these algorithms were objective and understandable (Talu, 1999) made the mathematical activities more understandable. In addition, Çopur (2020) concluded that using Web 2.0 tools (Edmodo, LearningApps.org, Kahoot) effectively teaches algorithms, which shows the importance of supporting our research with digital content.

Students' awareness of algorithmic thinking before the application was explained with a total of 15 codes, 7 codes at the lowest level, 5 codes at the low level, and 3 codes at the medium level. After the application, their awareness was explained with 43 codes, including 25 codes at the medium level, 14 at the high level, and 4 at the highest level. Parallel to the increase in students' knowledge levels, the number of codes produced increased from 15 to 43, and there was a noticeable increase in the variety of codes. With the increase in the number and variety of codes produced, it is understood that students comprehend the logic and usage areas of algorithmic thinking. Guler (2021) obtained results that the algorithmic thinking course provides academic and life-related thinking skills, which supports the results of our study. The diversity of algorithm-based studies in different disciplines and subject areas shows that this result is predictable (Atabay, 2019; Galezer et al., 1995; Korkmaz et al., 2015; Papadakis & Kalogiannakis, 2019). Pre-service teachers found the algorithmic thinking course useful because it improved their algorithmic thinking skills; they reported that it was effective and useful (Guler, 2021). In addition, Yıldırım (2019) determined that activities involving algorithms contribute to students' knowledge-creation processes, which coincides with the results of our study.

Students' opinions on the use of algorithmic content in mathematics lessons after the application was explained with 35 codes, 17 codes at the medium level, 12 at the high level, and 6 at the highest level. Of these codes, 28 contain a positive perspective, and 7 contain a negative perspective. From the positive perspective, the logic of using algorithms in mathematics lessons was understood, and the activities were found to be fun and instructive, facilitating interesting and revealing prior knowledge. It has been determined that activity-based algorithm applications support children's problem-solving skills and that students enjoy and love these activities (Kucukkara, 2019; Yildiz, 2020). The results of these studies support the results of our research. It has been determined that applications such as games, Scratch, and Kodu Game Lab increase students' problem-solving skills (Alkan, 2019). In addition, it has been determined that these applications positively affect students' perspectives toward mathematics courses and their attitude scores (Sonmez, 2018; Yildiz, 2020). The fact that the algorithm is effective in solving a problem based on a standard algorithm (Topal, 2015), in creating algorithms about fractions (Yildirim, 2019), on mathematics self-efficacy (Psycharis & Kallia, 2017) shows the importance of this research supported by student opinions.

From the negative perspective, the students found these activities tiring and boring because they were limited in progressing step by step and reaching the result immediately. The fact that gifted students are individuals with fast thinking, problem-solving, and technology utilization skills may have been effective in this result. Although doing algorithmic activities can be tiring and boring, algorithmic thinking is an important skill for the development of skills such as analytical and systematic thinking (Hromkovič, 2006; Saeli et al., 2011), planned work, understanding problem situations and producing appropriate solutions (Coufal et al., 2017; Dasso et al., 2005; Saeli et al., 2011), and using technology effectively (Yi & Mogilski, 2015). This study contributed to developing skills such as communication, learning to learn, problem-solving, and technology literacy, which will be developed in support education program students.

Recommendations

The study was conducted with gifted students studying at the 4th-grade primary school level. Students with normal development can be included in the study with gifted students, and comparisons can be made. Research can be conducted to examine the effect of algorithm-based mathematics activities on gifted students' problem-solving skills, attitudes toward mathematics, or attitudes toward computational thinking skills. The study was obtained from the questions in the students' semi-structured interview form. In future studies, the research results can be interpreted from a broader perspective by including study groups, including primary, secondary, and high school students.

Limitations of Study

This research is limited to the qualitative research method, and the case study design carried out with this method. It is limited to 17 primary school 4th-grade students studying at the Science and Art Center in Afyonkarahisar province in the 2021-2022 academic year. The data obtained are limited to the interview form containing three questions created for this study. The research is limited to activities carried out for four weeks and four hours a week.

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References

Aho, A. V. (2012). Computation and computational thinking. *Computer Journal*, *55*(7), 832-835. https://doi.org/10.1093/comjnl/bxs074

Alkan, A. (2019). The effect of code game lab software on the level of problem solving skills in programming language teaching. *Mehmet Akif Ersoy University Journal of Education Faculty, 50*, 480-493. https://doi.org/10.21764/maeuefd.486061

Atabay, E. (2019). *Okul öncesi dönem çocuklarına oyunlaştırma ile algoritma eğitimi verilmesi* [Giving algorithm education with the gamification to preschool period children]. Master thesis. Süleyman Demirel University, Isparta.

Ataman, A. (2000). *Üstün yetenekli çocuklar. Özel eğitime giriş* [Gifted children. Introduction to special education]. Anadolu Üniversitesi Yayınları.

Avcu, Y. E., & Yaman, Y. (2022). Effectiveness of the differentiated instructional design for value education of gifted: A mixed study. *Journal of Gifted Education and Creativity, 9*(1), 1-23.

Brown, W. (2015). *Introduction to algorithmic thinking*. Retrieved from: https://raptor.martincarlisle.com/Introduction%20to%20Algorithmic%20Thinking.doc

Bundy, A. (2007). *Computational thinking is pervasive*. Retrieved from: http://www.inf.ed.ac.uk/publications/online/1245.pdf

Can, A. (2019). *SPSS ile bilimsel araştırma sürecinde nicel veri analizi* [Quantitative data analysis in scientific research process with SPSS] (7th Edition). Pegem Akademi.

Coufal, P., Hornik, T., Hubalovsky, S., & Musilek, M. (2017). Simulation of the automatic parking assist system as a method of the algorithm development thinking. *International Journal of Education and Information Technologies*, *11*, 37-43.

Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches* (2nd ed.). Sage Publications.

Copur, K. D. (2020). *Algoritmik düşünme öğretimi sürecinde web 2.0 araçlarının kullanımı* [Use of web 2.0 tools in algorithmic thinking teaching process]. Master thesis. Erciyes University, Kayseri.

Dasso, A., Funes, A., Riesco, D. E., Montejano, G. A., Peralta, M., & Salgado, C. (2005, April 14-15). Teaching programming. I Jornadas de Educación en Informática y TICs en Argentina, Buenos Aires, República Argentina.

Demir, U., & Cevahir, H. (2020). Investigation of the relationship between algorithmic thinking capability and problem solving skills: The case of vocational and technical anatolian high school. *Kastamonu Education Journal, 28*(4), 1610-1619. https://doi.org/10.24106/kefdergi.4179

Dogan, U., & Kert, S. B. (2016). Bilgisayar oyunu geliştirme sürecinin, ortaokul öğrencilerinin eleştirel düşünme becerilerine ve algoritma başarılarına etkisi. *Bogazici University Journal of Education, 33*(2), 21-42.

Fernández, E., García, T., Arias-Gundín, O., Vázquez, A., & Rodriguez, C. (2017). Identifying gifted children: Congruence among diferent IQ measures. *Frontiers in Psychology, 8*(1239), 1-10. https://doi.org/10.3389/fpsyg.2017.01239

Galezer, J., Beeri, C., Harel, D., & Yehudai, A. (1995). A high-school program in computer-science. *Computer*, *28*(10), 73-80. https://doi.org/10.1109/2.467599

Gardner, H. E. (2011). *Leading minds: An anatomy of leadership*. Hachette UK.

Guler, C. (2021). Algorithmic thinking skills without computers for prospective computer science teachers. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science], 14*(4), 570-585.

Guven, Y. (2018). *5. sınıf bilişim teknolojileri ve yazılım dersi öğretmen rehber kitabı* [5th grade information technologies and software course teacher guide book], *1*, 163-164, Ministry of National Education.

Hamdaoui, N., Khalidi Idrissi, M., & Bennani, S. (2015). "Resorting to IMS-LD to standardize the learning process of Serious Game design in education," *International Journal of Education and Information Technologies, 9*, 36-45.

Hromkovič, J. (2006, November 7-11). Contributing to general education by teaching informatics. *International Conference on Informatics in Secondary Schools-Evolution and Perspectives*, Vilnius, Lithuania.
Hsu, C. C., & Wang, T. I. (2018). Applying game mechanics and student-generated questions to an online puzzle-based game learning system to promote algorithmic thinking skills. *Computers & Education, 121*, 73-88. https://doi.org/10.1016/j.compedu.2018.02.002
Hubalovsky, S., & Korinek, O. (2015). Evaluation of algorithmic thinking of students using control testing environment. *International Journal of Education and Information Technologies*, *9*, 205-208.
Karakus, F., & Baki, A. (2020). From chaotic to order: Using chaos game in mathematics teaching. *Turkish Journal of Computer and Mathematics Education*. Advanced publication. http://doi.org/10.16949/turkbilmat.541136
Kodla & Oyna. (2022, April 15). *ALGORİTMA nedir sorusuna en güzel örnek...* [The best example of what is ALGORITHM] [Video]. YouTube. https://youtu.be/xoqQKFtfzvM
Komarudin, K., Suherman, S., Puspita, L., Arrafiansyah, R., & Hasanah, U. (2020). Program course lab 2.4 mathematics learning media for increasing of creativity domain at Higher Order Thinking Skills (HOTS). *Journal of Gifted Education and Creativity, 7*(3), 131-136.
Kordaki, M. (2013). High school computing teachers' beliefs and practices: A case study. *Computers & Education, 68*, 141-152. https://doi.org/10.1016/j.compedu.2013.04.020
Korkmaz, O. (2012). The impact of critical thinking and logico-mathematical intelligence on algorithmic design skills. *Journal of Educational Computing Research, 46*(2), 173-193.
Korkmaz, O., Cakır, R., Ozden, M. Y., Oluk, A., & Sarioglu, S. (2015). Investigation of individuals' computational thinking skills in terms of different variables. *Ondokuz Mayis University Journal of Faculty of Education*, *34*(2), 68-87.
Krutetskii, V. A. (1976). *The psychology of mathematical abilities in school children*. University of Chicago Press.
Kucuk Demir, B., & Duzen Karatepe, U. (2022). Investigation of the effects of mathematics-centered stem activities on students' creative thinking skills and student opinions. *Journal of Gifted Education and Creativity, 9*(1), 25-41.
Kucukkara, M. F. (2019). *Etkinlik temelli algoritma eğitiminin 5-6 yaş çocuklarının problem çözme becerisine etkisi* [The effect of activity based algorithm education on the problem-solving skills of 5-6 years old children]. Master thesis. Bolu Abant İzzet Baysal University, Bolu.
Mayer, R. E. (1981). The psychology of how novices learn computer-programming. *Computing Surveys*, *13*(1), 121-141.
McMillan, J. H. (2000). *Educational research: Fundamentals for consumer*. Longman.
McMillan, J. H., & Schumacher, S. (2014). *Research in education: Evidence-based inquiry* (7th ed.). Pearson Education Inc.
Miller, R. C. (1990). *Discovering mathematical talent*. Council for Exceptional Children, ERIC Clearinghouse on Disabilities and Gifted Education. ERIC Document Reproduction Service No: ED 321487.
Ministry of National Education [MoNE] (2018). *Matematik dersi öğretim programı (ilkokul ve ortaokul 1, 2, 3, 4, 5, 6, 7 ve 8. sınıflar)* [Mathematics curriculum (primary and secondary school grades 1, 2, 3, 4, 5, 6, 7 and 8]. Retrieved from: https://mufredat.meb.gov.tr/ProgramDetay.aspx?PID=329
Ministry of National Education [MoNE] (2021). *Çerçeve programlar: Bilim ve sanat merkezleri Matematik dersi öğretim programı* [Framework programmes: Science and art centres Mathematics curriculum]. Retrieved from: Mebbis/Bilsem Modülü: https://bilsem.meb.gov.tr/BLS00002.aspx
Navas-Sánchez, F. J., Carmona, S., Alemán-Gómez, Y., Sánchez-González, J., Guzmán-de-Villoria, J., Franco, C., et al (2016). Cortical morphometry in frontoparietal and default mode networks in math-gifted adolescents. *Human Brain Mapping, 37*(5), 1893-1902.
Oluk, A., Korkmaz, O., & Oluk, H. A. (2018). Effect of Scratch on 5th graders' algorithm development and computational thinking skills. *Turkish Journal of Computer and Mathematics Education, 9*(1), 54-71.
Ozlu-Unlu, O., Arslanoglu, A., & Yikmis, A. (2022). Özel gereksinimli bireylere matematik öğretiminde somut-yarı somut-soyut öğretimin kanıta dayalı uygulama olarak belirlenmesi [Identifying concrete-representational-abstract instruction as an evidence-based practice in teaching mathematics to individuals with special needs]. *Ankara University Faculty of Educational Sciences Journal of Special Education, 23*(4), 931-960. https://doi.org/10.21565/ozelegitimdergisi.938438
Papadakis, S., & Kalogiannakis, M. (2019). Evaluating a course for teaching introductory programming with Scratch to pre-service kindergarten teachers. *International Journal of Technology Enhanced Learning*, *11*(3), 231-246. https://doi.org/10.1504/Ijtel.2019.100478
Patton, M. Q. (2002). *Qualitative research and evaluation methods*. Sage.
Pfeifer, S. I. (2012). Current perspectives on the indentifcation and assessment of gifted students. *Journal of Psychoeducational Assessment, 30*(1), 3-9. https://doi.org/10.1177/0734282911428192
Polya, G. (1962). *Mathematical discovery: On understanding, learning and teaching problem solving* (Vol I). Wiley Press.
Psycharis, S., & Kallia, M. (2017). The effects of computer programming on high school students' reasoning skills and mathematical self-efficacy and problem solving. *Instructional Science, 45*(5), 583-602.
Renzulli, J. S. (2012). Reexamining the role of gifted education and talent development for the 21st Century: a four-part theoretical approach. *Gifted Child Quarterly, 56*, 150-159. https://doi.org/10.1177/0016986212444901

Saeli, M., Perrenet, J., Jochems, W. M., & Zwaneveld, B. (2011). Teaching programming in secondary school: a pedagogical content knowledge perspective. *Informatics in Education*, *10*(1), 73-88.

Sonmez, D. (2018). *İlkokul matematik öğretiminde öğrencilerin duyuşsal farkındalıklarını artırmada matematiksel oyunların kullanımı* [The use of mathematical games to improve students' affective awareness in primary school mathematics teaching]. Master thesis. Yıldız Teknik University, İstanbul.

Sriraman, B. (2005). Are giftedness and creativity synonyms in mathematics?. *Journal of Secondary Gifted Education, 17*(1), 20-36.

Talu, N. (1999). Çoklu zekâ kuramı ve eğitime yansımaları [Multiple intelligence theory and its reflections on education]. *Hacettepe University Journal of Education, 15*, 164-172.

The Scientific and Technological Research Council of Türkiye [STRCT] (2022). *Ortaokul Öğrencileri Araştırma Projeleri Yarışması Proje Rehberi 2204-B* [Secondary school students research projects competition project guide 2204-B], Retrieved from: https://tubitak.gov.tr/sites/default/files/2750/ortaokul_proje_rehberi_2022_v3.pdf

Topal, A. (2015). *Ortaokul 6. sınıf öğrencilerinin standart bir algoritmayla çözülebilen ve çözülemeyen problemlerde kullandıkları matematiksel düşüncelerinin incelenmesi* [The examination of mathematical reasoning used by 6th grade students to solve process-constrained and process-open questions]. Master thesis. Gaziantep University, Gaziantep.

Umay, A. (2003). Matematiksel muhakeme yeteneği [Mathematical reasoning ability]. *Hacettepe University Journal of Education, 24*, 234-243.

Van de Walle, J. A., Karp, K. S., & Bay-Williams, J. M. (2021). *İlkokul ve ortaokul matematiği: Gelişimsel yaklaşımla öğretim* [Elementary and Middle School Mathematics-Teaching Developmentally] (S. Durmuş, Çev. Ed.). Nobel Yayıncılık.

Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, *49*(3), 33-35. https://doi.org/10.1145/1118178.1118215

Yildirim, B. (2019). *Ortaokul 6. Sınıf öğrencilerinin kesirlerle bölme algoritması oluşturma sürecinin incelenmesi* [An investigation into the development process of the division algorithm in fractions by 6'th grade students']. Master thesis. Bolu Abant İzzet Baysal University, Bolu.

Yildirim, C. (2018). *Matematiksel düşünme* [Mathematical thinking] (14th Edition). Remzi Kitabevi.

Yildirim A., & Simsek, H. (2006). *Sosyal bilimlerde nitel araştırma yöntemleri* [Qualitative research methods in social science] (6th Edition). Seçkin Yayıncılık.

Yildiz, M. N. (2020). *Algoritma öğretiminde kutu oyunu kullanılmasının ilkokul öğrencilerinin algoritma başarısına etkisinin incelenmesi* [Investigation of algorithm achievements on primary school students by using the board game in algorithm teaching]. Master thesis. Bahçeşehir University, İstanbul.

Yi, T., & Mogilski, J. (2015). "Customizing course redesign and flipped classroom models to improve learning environment," *International Journal of Education and Information Technologies, 9*, 135-142.

Yurtbakan, E., & Aydogdu-Iskenderoglu, T. (2023). The effect of STEM for gifted activities' mathematical problem-posing skills of gifted primary school students. *Journal of Gifted Education and Creativity,10*(2), 97-112.

Yunkul, E., Durak, G., Cankaya, S., & Misirli, Z. A. (2017). The effects of scratch software on students' computational thinking skills. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education*, *11*(2), 502-517. https://doi.org/10.17522/balikesirnef.373424

Annex 1. Activity Plan Sample

Activity Plan

Activity Name: My Digital Algorithm
Suggested Duration: 40′+40′+40′+40′
Activity Outcomes: Outcome 1. Understands the logic of the algorithm. Outcome 2. Creates an algorithm for solving a problem. Outcome 3. Performs commands according to the given algorithm.
Interdisciplinary Cooperation: Mathematics
Learning-Teaching Methods and Technques: Lecture, question-answer, demonstration
Explanations: ➢ The mathematics outcome for the activity is determined. ➢ A problem addressing this outcome is written. ➢ The solution steps of this problem are determined. ➢ An algorithm is prepared by placing these steps in a flowchart. ➢ It is checked whether the algorithm works or not. ➢ The prepared algorithm is transferred to the Web 2 tool. ➢ Students apply the algorithm steps. ➢ Presentation of the algorithm is realized. ➢ Student presentations are evaluated.
Educational Technologies And Equipment Used: Teacher: Interactive board, Lucidchart Web 2 tool Student: Paper, pencil, eraser, crayons