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The Effectiveness of the Treffinger Learning Model Assisted by a Web Authoring Platform on Students' Mathematical Problem-Solving Ability

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Abstract

This study aims to describe the effectiveness of the Treffinger learning model assisted by a web authoring platform on the mathematical problem-solving abilities of grade VII junior high school students on algebraic form material. The method used in this study is an experiment with a pre-experimental design with a One Group Pretest-Posttest Design. The research instrument is a mathematical problem-solving ability test given before and after treatment. The results of data analysis using the paired sample t-test showed that the t_{hitung} value of -12.416 is smaller than the $-t_{tabel}$ of -1.725 and the p-value of 0.001 <0.05. This shows that there is a significant difference between the pretest and posttest results, which means that the Treffinger model assisted by Google Sites has an effect on improving students' mathematical problem-solving abilities. The average pretest score of 43.429 increased to 74.143 in the posttest, showing an increase of 30.714%. This study shows that the application of the Treffinger learning model assisted by Google Sites can be an effective alternative in mathematics learning to improve students' problem-solving abilities.

Keywords: *Treffinger; Google Sites; Mathematical Problem Solving Ability*

Introduction

Education is one of the important things in a person's life. Education is one of the determinants of a person's growth and development and even becomes an assessment of a person's success in their life. Education has a very important role in shaping the quality of individuals and determining the success of a nation (Rodiawati & Komarudin, 2018). Education is not only carried out in a formal context, but also has measurable goals, as stated in Law of the Republic of Indonesia Number 20 of 2003 Article 3, that national education aims to develop the potential of students to become individuals who are faithful, creative, independent, and responsible. In the context of formal education, schools are a strategic place to realize educational goals through learning in various fields of study, including mathematics (Kharisma & Asman, 2018).

Mathematics is known as a science that underlies various other disciplines and plays an important role in everyday life (Maulida et al., 2022). In addition, mathematics is also an exact and abstract science, which provides many benefits for human survival. On the other hand, mathematics requires us, especially

students, to understand and follow all its rules so that they can be applied, thus providing a great positive impact on life (Agnesti & Amelia, 2021). Mathematics also acts as a means that helps us, especially students, to be more creative, careful, critical, innovative, and able to think logically. Mathematics teaches us to be individuals who do not give up easily in finding solutions, which ultimately fosters a sense of satisfaction and self-pride (Fauziah & Puspitasari, 2022). This makes mathematics an important element in life. This subject must be taught to all students, from Elementary School to College, mathematics learning is not only aimed at mastering concepts and procedures, but also to develop logical, critical, creative, and systematic thinking skills (Yulia & Gusniarti, 2019).

According to the National Council of Mathematics (NCTM), there are five mathematical thinking skills that students must have, namely problem-solving skills, communication skills, connection skills, reasoning skills and representation skills. One of the essential skills in learning mathematics is mathematical problem-solving skills, namely the ability to understand problems, design strategies, and find logical and meaningful solutions. This ability is very important because it reflects the higher order thinking skills needed to face the challenges of the 21st century (Dewanti et al., 2020). In the Regulation of the Minister of National Education of the Republic of Indonesia Number 22 of 2006 concerning the objectives of mathematics learning, including problem-solving skills, including; understanding problems, designing mathematical models, solving models and interpreting the solutions obtained (Depdiknas, 2006). So that mathematical problem-solving skills are one of the mathematical abilities that need to be developed in mathematics learning.

However, various international studies such as PISA and TIMSS show that the mathematical problem-solving abilities of students in Indonesia are still relatively low. Based on the results of the 2018 Programme for International Student Assessment (PISA) in the field of numeracy and literacy, it shows that the abilities of Indonesian students are in sixth position from the bottom, namely 72nd out of 78 countries (Hewi & Shaleh, 2020). Furthermore, Kemendikbud stated that Indonesia's PISA results in 2022 had decreased by 12 to 13 points. However, Indonesia's ranking in PISA 2022 for mathematical literacy rose 5 positions compared to PISA 2018. In addition, the Trends in International Mathematics and Science Study (TIMSS) in 2015 also revealed another fact where Indonesia was ranked 44th out of 49 countries. The results of this study highlight achievement in mathematics, which shows that 54% are at a low level, 15% at a medium level and only 6% reach a high level (Ariati & Juandi, 2022). This is reinforced by findings in the field which show that students have difficulty in understanding algebra material, especially in identifying and operating abstract algebraic forms. These difficulties often stem from a lack of conceptual understanding, inaccuracy, and the inability of students to apply appropriate problem-solving strategies. This is in line with research conducted by Ying et al., (2020) showing that several types of student learning difficulties in algebra include: Students have difficulty in identifying variables, coefficients, constants, and similar rates, difficulty in simplifying algebraic forms, difficulty in using the properties of distributive multiplication and mathematical arithmetic operations, and difficulty in creating mathematical models of a statement or everyday problem. Research (Pramesti & Retnawati, 2019) also states that students' errors in solving problems related to algebraic material cover at least three things, namely: understanding the problem, understanding the meaning of variables and operating algebraic forms.

In an effort to overcome these problems, an innovative learning model is needed that can facilitate the development of students' problem-solving abilities optimally. One relevant model is the Treffinger learning model, which emphasizes the development of cognitive and affective skills through gradual and structured problem-solving stages. The Treffinger model is a model that seeks to encourage students to think creatively in solving problems by paying attention to important facts in the surrounding environment and then generating various ideas and choosing the right solution to be implemented in real terms (Treffinger, 1980). According to Munandar (2009), this Treffinger model is very suitable for the mathematics learning process, especially in matters of solving non-routine problems. In addition, according to Yulinsa et al. (2021) he Treffinger learning model is a model that involves cognitive and

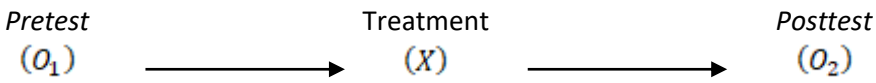
affective skills in each learning process that can influence the process of students' mathematical problem-solving abilities. This model is believed to be able to foster students' creativity and critical thinking skills in dealing with complex mathematical problems. In this treffinger model there are 3 basic steps, namely Basic Tools (introduction stage or warm-up stage in the learning process), Practice with Process (here students solve problems through discussion), and Working with real problems (solving problems by relating them to everyday life), all of these basic steps are very effective for use in improving students' mathematical problem-solving abilities (Munandar, 2009). Thus, learning using the treffinger model is expected to foster students' creativity in teaching and learning activities (Sepriyanti et al., 2017).

In addition to the right pedagogical approach, technology integration is also an important factor in creating an interesting and effective learning experience. The use of Google Sites as an interactive learning media provides a new alternative in delivering material, practice questions, and learning evaluations flexibly and easily accessible. The Google Sites application is a Google feature in the form of a web to combine various information in one place (Putri & Sulistyono, 2022). Google sites are facilities on Google that have visit features that are managed in the form of a website. Meanwhile, Google site-based teaching materials are a learning platform in the form of a website that is attractively designed to make it easier for teachers and students to access information in the learning process. Google sites-based teaching materials can be accessed using gadgets and laptops or computers (Khoiriyah et al., 2024). he use and uniqueness of Google sites in learning media include the ease of delivering lesson materials, giving assignments, conducting online assessments, and so on. Teachers will also not be constrained in sharing various types of files, images and videos via Google sites. Students will also not be constrained in accessing the website, only an Android/laptop connected to the internet network is needed (Sulasmianti, 2021). Google Sites allows teachers to present teaching materials with attractive visualizations and facilitate students' independent learning, so it is very potential in improving mathematical problem-solving skills. Google Sites can be a very useful tool in improving students' mathematical problem-solving skills. With its interactive features, Google Sites allows content creators to create engaging and easily accessible learning experiences. Thus, students can learn mathematics more effectively and enjoyably.

Based on this urgency, this study aims to examine the effectiveness of the Treffinger learning model assisted by Google Sites on students' mathematical problem-solving abilities in algebraic form material. This study is expected to contribute to the development of innovative, adaptive, and responsive learning strategies to students' needs and today's educational challenges.

Method

This research is a quantitative research using experimental methods. The research design used is pre-experimental design, which is a design that only involves one experimental class without a control class. The form of pre-experiment used in this study is One Group Pretest-Posttest Design. In this design, measurements are carried out twice, namely before treatment and after treatment. Observations made before treatment (O_1) are called pretests, and observations made after treatment (O_2) are called posttests. The experimental group is given learning with the treffinger learning model assisted by google sites. Before the research is carried out, the experimental group will be given a pre-test to see and measure students' initial abilities. After the pre-test is carried out, the experimental group will be given treatment by implementing the treffinger learning model assisted by google sites for several meetings according to the predetermined schedule. After the treatment is given, students will take a posttest to find out how far their abilities have improved after following the learning process. According to Sugiyono (2018), the design scheme with the one group pretest-posttest model is as follows:



Information: X: Treat using the treffinger learning model
O_1: Initial test scores before treatment (pretest)
O_2: Final test score after treatment (posttest)

This design was chosen due to time considerations and limited conditions in the field. The research implementation time available was only a few weeks, so it was not possible to involve two groups (experimental and control) simultaneously. Research with two groups requires more complex planning and implementation, both in terms of scheduling coordination, treatment delivery, and data collection. By using the same group for the pretest and posttest, the research process can be carried out more simply and focused, but still provides an overview of the effects of the treatment given. This design is also more appropriate for school situations that have a busy learning schedule and limited time allocation for research activities outside the main curriculum.

The subjects in this study were grade VII students at a private junior high school located in Demangan Baru, Depok, Sleman, Special Region of Yogyakarta. This school is under the auspices of an Islamic community organization and has characteristics as an educational institution based on Islamic values that integrates general and religious education. The learning process takes place in the classroom on algebraic material. This research was conducted in the odd semester of the 2024/2025 academic year in October with a total of 5 meetings. The population in this study were 93 grade VII students divided into four classes. While the sample used was with the selected class totaling 25 students, and selected using a random sampling technique (simple random sampling) where the sample was assumed to be homogeneous. Random sampling obtained four classes as samples. From the four classes, random selection was carried out, and class 7 Creative 2 was obtained as the experimental class.

The procedure for implementing this one-group pretest-posttest model research is:

1. Providing O_1, which is a pretest to measure students' initial mathematical problem-solving abilities.
2. Providing treatment using the Treffinger learning model assisted by Google Sites, to students. According to Munandar (2009), this Treffinger model is very suitable for the mathematics learning process, especially in matters in solving non-routine problems. The ability to solve mathematical problems is not an ability that can be obtained in an instant, but building it must be with practice questions and getting used to doing it continuously. Treffinger's learning steps consist of three levels, namely as follows:
    a. Level I, Basic tools or Level I creativity techniques include divergent thinking skills and creative techniques. The learning activities in stage I in this study are: (1) the teacher gives an open problem with more than one solution, (2) the teacher guides students to have a discussion to convey their ideas or thoughts, while also giving an assessment to each group.
    b. Level II, Practice with process or level II creativity techniques, provides students with the opportunity to apply the skills they have learned in level I in practical situations. The learning activities in stage II in this study are: (1) the teacher guides and directs students to discuss by providing analogous examples, (2) the teacher asks students to make examples in everyday life.
    c. Stage III, Working with real problems or level III creativity techniques. Applying the skills learned in the first two stages to real-world challenges. Students use their abilities in ways that are meaningful to their lives. Students not only learn creative thinking skills, but also how to use this information in their lives.

3. Providing O_2, which is a posttest to determine the results of changes in students' mathematical problem-solving abilities.
4. Comparing the pretest and posttest to determine how much difference is caused.
5. Applying statistical analysis to determine how much influence the Treffinger learning model assisted by Google Sites has on students' mathematical problem-solving abilities.

The instruments used in this study were pretest and posttest tests aimed at measuring students' mathematical problem-solving abilities. This instrument consists of 4 essay-shaped questions, which have gone through an expert validation process to ensure the validity of the content and reliability. To ensure the validity of the instrument's content, the Aiken's V index technique was used. The validity results showed that all questions in the pretest and posttest tests had Aiken's V values between 0.92 and 0.97 which were in the high validity category. So the instrument was declared valid and suitable for use. Furthermore, the reliability test of the instrument was carried out using the Alpha Cronbach formula, and the results of the pretest and posttest instrument reliability coefficients were 0.69 and 0.66. According to Nitko & Brookhart (2014), an instrument is said to be reliable if it is more than 0.65, so it can be concluded that the instrument in this study is reliable. In addition, an observation sheet for the implementation of learning was also used to ensure that the implementation of learning in the classroom was in accordance with the steps that had been set. This observation sheet contains the implementation of learning steps according to the Treffinger learning model assisted by Google Sites and is arranged in the form of "yes" and "no" columns which can be filled with a checklist mark to indicate that the intended steps have been implemented.

The research data obtained from the pretest and posttest results were analyzed using descriptive statistical analysis to determine the tendency of data before and after the implementation of the Treffinger learning model assisted by Google Sites on mathematical problem solving abilities. The indicators of mathematical problem solving abilities used in this study can be seen in Table 1 below.

Table 1. Indicators of Students' Mathematical Problem-Solving Ability

Aspect	Indicator
Understanding the problem	Write down relevant information that includes what is known and asked about the given problem.
Develop a problem-solving plan	Using known and asked information to develop a plan based on facts.
Implementing a problem-solving plan	Carry out the planned problem-solving plan and write down the correct answer completely, systematically, and correctly.
Double-check the answers	Checking or rechecking the answers obtained are in accordance with the provisions and there are no contradictions with what was asked and writing conclusions according to what was asked completely and correctly.

After that, inferential statistical analysis was conducted to test the research hypothesis. Before conducting the hypothesis test, a prerequisite test was first conducted, namely the normality test. The normality test was conducted using the Shapiro-Wilk test. Data is said to be normally distributed if the significance value $(p - value) > 0{,}05$, so that H_0 is accepted, which means that the data comes from a normally distributed population. If the data is proven to be normally distributed, the analysis is continued with a hypothesis test using the paired sample t-test. The decision-making criteria for the paired t-test are that if the $p - value < 0{,}05$ then H_0 is rejected, which means that there is a significant difference between the pretest and posttest values. In other words, if $t_{hitung} < -t_{tabel}$ then H_0 is also rejected, which indicates that the posttest value is significantly higher than the pretest value after the application of the Treffinger learning model assisted by Google Sites.

Results and Discussion

1. Results

The results of the data analysis that have been obtained in this study are divided into two parts, namely the results of descriptive data analysis and the results of inferential data analysis. The following is an explanation of the results of the data analysis that have been obtained.

Descriptive Analysis Results

Descriptive statistics consist of a description of the implementation of learning and a description of data analysis. What is meant by a description of the implementation of learning is a description or explanation of the extent to which a planned learning activity is actually implemented in the teaching and learning process. In this study, learning using the Treffinger learning model assisted by Google Sites on students' mathematical problem-solving abilities was carried out with 5 meetings, 1 meeting for giving a pretest, 1 meeting for giving a posttest, and 3 meetings for providing learning using the Treffinger learning model using Google Sites. In addition, during the learning process, an observation sheet for the implementation of learning was filled out. The results of the observation sheet for the implementation of learning in the class with the Treffinger learning model assisted by Google Sites are presented in Table 2 below.

Table 2. Percentage of Learning Implementation Observation Sheet Results

Meeting to	Percentage of Teacher Activities (%)	Percentage of Student Activities (%)	Mean (%)	Information
1	95%	95%	95%	Well executed
2	100%	100%	100%	Well executed
3	100%	100%	100%	Well executed
Mean (%)	98,33%	98,33%	98,33%	Well executed

Based on Table 2, it can be seen that at the first meeting the percentage of teacher activities carried out was 95% because the teacher did not say an opening greeting and did not guide students to pray together before starting the learning activities and the percentage of student activities carried out was 95% because students did not answer the opening greeting and did not pray together according to their respective beliefs and religions. At the second and third meetings, teacher and student activities were carried out 100%. So it can be concluded overall that, observations on the implementation of the Treffinger learning model assisted by Google Sites are said to be carried out well and in accordance with the teaching module.

Furthermore, what is meant by data analysis description is a written description or explanation of the results of data processing that has been carried out, both quantitative and qualitative data. The data obtained in this study are data on students' mathematics learning outcomes. Student learning outcomes are based on students' mathematical problem-solving abilities taught by implementing the Treffinger learning model assisted by Google Sites. The data is described based on the analysis of the initial test data (pretest) and the final test (posttest). The data from the pre-test and post-test results of the mathematical problem-solving abilities of the research class are presented in Table 3 below:

Table 3. Results of Pre-Test and Post-Test of Mathematical Problem-Solving Ability

Description	Experimental Class	
	Pretest	*Posttest*
Number of Students	21	21
Mean	43,429	74,143
Standard Deviation	9,250	10,504
Minimum Value	31	58
Maximum Value	69	96

Based on Table 3 above, it can be seen that the mathematical problem-solving ability of students in the experimental class has increased. The average pre-test result of students' mathematical problem-solving ability was 43.429. After being given mathematics learning treatment using the Treffinger learning model assisted by Google Sites, the average post-test result of students' mathematical problem-solving ability increased to 74.143. The minimum and maximum values respectively during the pre-test were 31 and 69, then increased to 58 and 96 during the post-test. The average score of each indicator of mathematical problem-solving ability can be seen in Table 4 below.

Table 4. Average Pre-Test and Post-Test Per Indicator of Mathematical Problem-Solving Ability

Indicator	Information	Experimental Class		Improvement
		Pretest	*Postest*	
Understanding the problem	Mean	4,52	10,38	5,86
	(%)	(37,69%)	(86,51%)	(48,82%)
Develop a problem-solving plan	Mean	5,52	8,38	2,86
	(%)	(46,03%)	(69,84%)	(23,81%)
Implementing a problem-solving plan	Mean	7,05	9,52	2,47
	(%)	(58,73%)	(79,37%)	(20,64%)
Double-check the answers	Mean	3,71	7,24	3,53
	(%)	(30,95%)	(60,32%)	(29,37%)

In Table 4 above, it is obtained that the average mathematical problem-solving ability of students has increased in each indicator. The indicator of understanding the problem has increased by 5.86 or 48.82%, the indicator of compiling a problem-solving plan has increased by 2.86 or 23.81%, the indicator of implementing a problem-solving plan has increased by 2.47 or 20.64%, and the indicator of rechecking answers has increased by 3.53 or 29.37%. So, it can be said that learning mathematics using the Treffinger learning model assisted by Google Sites is able to improve students' mathematical problem-solving abilities.

Inferential Analysis Results

Inferential statistics consist of prerequisite tests and hypothesis tests. Before conducting a hypothesis test to see the effect of the Treffinger learning model assisted by Google Sites on mathematical problem solving skills, a prerequisite test is first conducted, namely the normality test. The normality test is a prerequisite in the hypothesis test because before the hypothesis test is conducted, the sample must come from a normally distributed population. Normality testing is carried out using the Shapiro-Wilk test with the help of the JASP application. The data from the normality test results are presented in Table 5 below.

Table 5. Results of Pretest and Posttest Data Normality Test of Mathematical Problem-Solving Ability

Class	W	$p-value$	Decision
Pretest of Mathematical Problem-Solving Ability	0,922	0,096	Normal
Posttest of Mathematical Problem-Solving Ability	0,911	0,058	Normal

Based on Table 5 above, it can be seen that the results of the normality test using the Shapiro-Wilk Wilk in the experimental class for the pre-test of students' mathematical problem-solving ability obtained a $p-value$ of 0,096. Because the $p-value$ is greater than α $(0{,}096 > 0{,}05)$ then H_0 is accepted. While the results for the post-test of students' mathematical problem-solving ability obtained $p-value$ of 0,058. Because the $p-value$ is greater than α $(0{,}058 > 0{,}05)$ then H_0 is accepted. Thus it can be concluded that the pre-test and post-test data for mathematical critical thinking ability come from a normally distributed population.

Next, hypothesis testing, after the prerequisite test is met, namely where the data comes from a normally distributed population, then hypothesis testing is carried out based on parametric analysis. Hypothesis testing is carried out to determine whether or not there is an influence of the Treffinger learning model assisted by Google Sites on mathematical problem-solving skills. The hypothesis test used is the paired sample t-test with the help of the JASP application. The results of the hypothesis test using the paired sample t-test obtained can be seen in Table 6 below.

Table 6. Paired Sample T-Test Results

Measure 1	*Measure 2*	t	df	$p-value$	t_{tabel}
Pre-Test	*Post-Test*	$-12{,}416$	20	$< 0{,}001$	$-1{,}725$

Based on Table 6 above, the hypothesis test using the paired sample t-test shows that the decision-making criteria are if $t_{hitung} < -t_{tabel}$, where $t_{tabel} = -1{,}725$ and if $p-value < \alpha$ (with $\alpha = 0{,}05$) then H_0 is rejected. The results of the analysis show that the t_{hitung} value is $-12{,}416$ and the $p-value$ is $< 0{,}001$. Because $-12{,}416 < -1{,}725$ and the $p-value$ $0{,}001 < 0{,}05$ then H_0 is rejected. Thus, there is a significant difference between the average pretest and posttest scores of mathematical problem-solving ability. The average posttest score is higher than the pretest, which indicates an increase in ability after treatment.

2. Discussion

Based on the results of descriptive and inferential analysis, the terffinger learning model assisted by Google Sites is effective for mathematical problem-solving skills. Furthermore, the researcher gave mathematical problem-solving ability test questions on algebraic content. The following are some excerpts of students' answers in answering mathematical problem-solving ability questions on algebraic material.

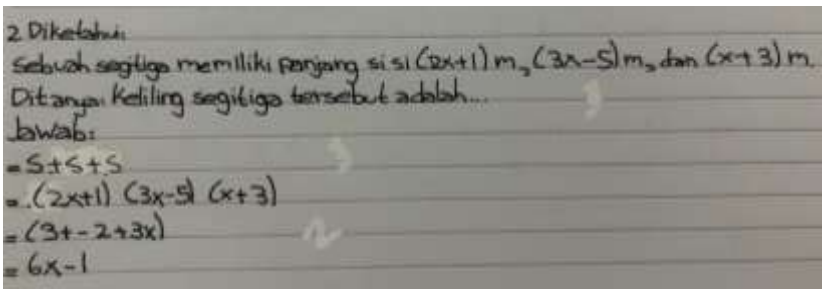


Figure 1. Mathematical Problem-Solving Ability Pretest Questions

Based on Figure 1, it shows that students' answers to the pretest questions, it can be seen that students have met several indicators in solving mathematical problems. First, students are able to understand the problem well, as shown by identifying known information, namely the length of the sides of the triangle: $(2x + 1)m, (3x - 5)m,$ and $(x + 3)m$, and knowing that what is being asked is the perimeter of the triangle. Second, students have also prepared a proper problem-solving plan, namely adding the three sides of the triangle to determine the perimeter. Third, in implementing the plan, students wrote the algebraic addition form correctly, but there was an error in the process of simplifying the expression. Although the final result obtained, namely $6x - 1$, is correct, the calculation process is not written correctly and coherently, so it can cause confusion. Finally, students have not met the indicator of rechecking the answer, because there is no evidence that students have reviewed or verified the process and the final result. Thus, although students' answers show good understanding and planning, guidance is still needed in compiling the steps for simplifying algebra correctly and getting used to rechecking the results of the work.

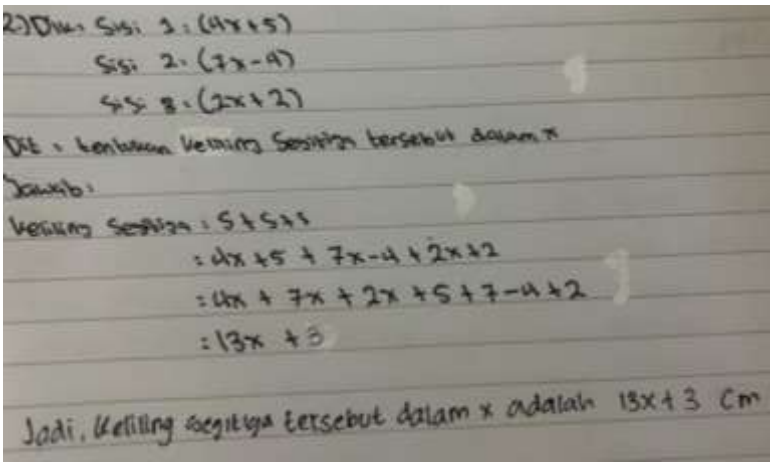


Figure 2. Mathematical Problem-Solving Ability Posttest Questions

Based on Figure 2, it shows that students' answers to the posttest questions show that students are able to solve the questions well and demonstrate mastery of all indicators of mathematical problem-solving abilities. Students have understood the problem correctly, namely knowing that what is requested is the circumference of a triangle with side lengths $(4x + 5), (7x - 4),$ and $(2x + 2)$. Furthermore, students are also able to formulate a problem-solving plan, namely by adding the three sides of the triangle to determine the circumference. At the stage of implementing the plan, students write down the addition steps sequentially and correctly, and simplify the algebraic form correctly to $13x + 3$. Finally, students have also rechecked their answers by writing the final results in a clear conclusion sentence that is in accordance with the context of the question. Therefore, this answer shows that students have met all indicators of problem solving completely and systematically.

Overall, the results of the study showed that students who participated in learning with the Treffinger model assisted by Google Sites experienced a significant increase in their mathematical problem-solving abilities, especially 7th grade junior high school students on algebraic form material. This finding certainly makes students more active, creative, and focused in solving mathematical problems and also shows that the Treffinger model, which emphasizes the stages of creative thinking and systematic problem solving, is able to provide a clear structure in students' thinking processes. In addition, support from Google Sites as a learning medium allows students to access materials, assignments, and learning resources more flexibly and visually, thereby strengthening their understanding of mathematical concepts. This can be seen from the increase in pretest and posttest scores, both overall and in each indicator of mathematical problem-solving abilities. All indicators of mathematical problem-

solving abilities, namely understanding the problem, developing a solution plan, implementing the plan, and rechecking the answers, have increased. This shows that the learning model used is effective in helping students develop their thinking skills and solve mathematical problems more systematically and in depth. This finding also reflects that learning with the Treffinger model provides space for students to practice creative thinking, formulate alternative solutions, and reflect on the problem-solving process independently.

The interpretation of these results can be explained through the characteristics of the Treffinger learning model. According to Sarson, as quoted by Huda (2014), the most dominant characteristic of the Treffinger learning model is its effort to integrate students' cognitive and affective dimensions to find directions for solutions that will be taken to communicate problem-solving solutions. This means that students are given the freedom to solve their own problems in the ways they want. The teacher's job is to guide students so that the directions taken by these students do not deviate from the problem. In addition, the Treffinger learning model also consists of 3 important components, namely Understanding Challenge, Generating Ideas, and Preparing for Action (Nuhoğlu & Akgül, 2019). Support from learning media such as Google Sites allows the presentation of learning materials and activities in a more interesting and interactive way, so that students can more easily understand concepts and are motivated to learn. Google Sites also facilitates independent learning access that can be repeated at any time and supports student-centered learning.

This study is consistent with the results of previous research Sepriyanti et al. (2017) which found that the Treffinger model is effective in improving the mathematical problem-solving abilities of junior high school students. Another study conducted by Layali & Masri (2020) explained that there was a significant difference in student learning outcomes using the Treffinger learning model and the Conventional learning model. The latest research conducted by Saripudin et al. (2024) juga menyatakan bahwa model pembelajaran treffinger memberikan pengaruh yang signifikan terhadap hasil belajar siswa. In addition, this study is also in line with research Data (2022) which stated that the use of Google Sites as a learning delivery tool and learning platform can increase engagement, independent learning, time management, and student learning outcomes. This can be seen from the responses of students who are more enthusiastic, active in discussions, and show increased learning independence when learning is carried out with Google Sites learning media. Another study was also conducted by Permana et al. (2024) which stated that digital learning media can increase student motivation and participation during the learning process. Suyuti et al. (2023) also showed that the use of technology in education has been shown to increase student learning motivation, expand access to educational resources, and develop collaborative skills needed in the modern world.

This shows that both learning models and digital technology can complement each other in improving the quality of learning. However, not all studies show similar results. Several previous studies have noted that the use of digital media alone without a clear learning strategy can cause disruption or decrease student focus. Therefore, the combination of a systematic learning model and the right media is the key to success as shown in this study, namely providing a new contribution by integrating Google Sites digital media into the implementation of the Treffinger learning model.

The novelty of this study lies in the integration between the Treffinger model and Google Sites learning media in the context of mathematics learning in junior high schools. Previous studies tend to examine the effectiveness of the Treffinger model or the use of digital media separately. In this study, the two approaches are combined synergistically, creating a creative, flexible, and technology-based learning atmosphere. In addition, the focus on mathematical problem-solving skills makes a special contribution to mathematics learning that demands high-level thinking.

Although the results of the study show positive impacts, there are several limitations that need to be considered. This study still has limitations in terms of learning context and sample size. To strengthen the generalizability of the results, further research can be conducted at other levels of education such as

high school or vocational school, as well as on different mathematics materials. Research can also examine the effect of this approach on other aspects such as creative thinking skills, attitudes towards mathematics, or digital literacy. In addition, the use of other more interactive platform-based digital media (for example, learning management systems or mobile applications) is also an interesting research opportunity in the future.

Conclusion

Based on the research results and discussions that have been explained previously, statistical tests using paired sample t-tests show that there is a significant difference between the pretest and posttest results. The results of the analysis indicate that the Treffinger learning model assisted by Google Sites has an effect on the mathematical problem-solving abilities of grade VII junior high school students on algebraic form material. This effect can be seen from the increase in the average value of the test results after treatment compared to before treatment, which indicates an increase in students' abilities in solving mathematical problems.

In addition, improvements also occurred in each indicator of problem-solving ability. The indicator of understanding the problem showed the most prominent increase, indicating that the learning model used was able to help students understand the context and content of the questions better. Meanwhile, the indicator of implementing a problem-solving plan also increased, although not as much as the other indicators. Overall, these results reinforce that the use of the Treffinger learning model combined with digital media such as Google Sites can have a positive impact on the development of students' mathematical problem-solving abilities.

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