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Effect of Canva Based Project Based Learning on Students' Mathematical Thinking Skills

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ABSTRACT

Mathematics instruction on plane figures often remains procedural and has not optimally developed students' mathematical thinking skills, particularly reasoning, representation, and problem solving. This condition highlights the need for instructional innovation that encourages students to engage actively in constructing meaningful mathematical concepts. This study aimed to analyze the implementation of instruction and examine the effect of Canva-assisted Project-Based Learning (PjBL) on students' mathematical thinking skills. A quantitative approach was employed using a quasi-experimental nonequivalent control group design. The participants were 40 seventh-grade students at MTs Nurul Hasan, consisting of an experimental group and a control group, with 20 students in each group. Data were collected through pretest-posttest assessments and classroom observations, and were analyzed using t-tests, N-gain, and effect size. The results showed that the implementation of the learning process was categorized as good. A significant difference was found between the experimental and control groups ($p < 0.05$). The average score of the experimental group increased from 47.00 to 84.25, with an N-gain of 0.70, which was categorized as high, and an effect size of 1.81, indicating a very large effect. These findings indicate that Canva-assisted Project-Based Learning has a strong effect on students' mathematical thinking skills. The novelty of this study lies in positioning Canva as a medium for supporting concept construction within Project-Based Learning.

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Introduction

Mathematical thinking skills regarding plane figures are an important competency in mathematics education. These skills encompass reasoning, representation, modeling, and problem solving, which are interrelated in students' thought processes (Khayroiyah et al., 2025). In a global context, these skills form part of mathematical literacy, which is assessed through the Programme for International Student Assessment (PISA), which also emphasizes reasoning and problem-solving skills in contextual situations (Habibi & Suparman, 2020). However, the results of the 2022 Programme for International Student Assessment (PISA) indicate that Indonesian students' mathematical literacy skills remain below the international average (Hermayanti et al., 2024). This situation indicates that students' reasoning, representation, and problem-solving skills have not yet developed optimally, particularly in the context of mathematics learning in schools (Audina, 2026). This issue is also evident in the teaching of plane geometry, which requires conceptual understanding as well as the ability to logically and systematically relate various geometric shapes (Iswanda et al., 2025).

Based on the results of initial observations conducted over three sessions at the beginning of the odd-semester of the 2025/2026 academic year in Grade 7 at MTs Nurul Hasan, it was found that instruction was still dominated by the lecture method, with low student engagement (Silfia et al., 2025). Observations showed that most students merely took notes and listened to the teacher's explanations without actively engaging in the process of discovering concepts. Additionally, students struggled to determine the correct formula, provide reasons for using the formula, and connect concepts between two-dimensional shapes, such as the relationship between squares and rectangles. On the other hand, previous studies have largely focused on improving mathematics learning outcomes but have not yet thoroughly examined mathematical thinking skills as a cognitive process that encompasses reasoning, representation, conceptual connections, and mathematical communication (Nursyam, 2026). Furthermore, the use of Canva in mathematics learning remains limited to serving as a visual presentation tool; it has not yet been directed toward serving as a means to build and construct mathematical concepts through meaningful project-based activities. Students use Canva to create visual representations of two-dimensional shapes, construct relationships between the concepts of area and perimeter, and present problem-solving processes systematically, thereby supporting the development of mathematical reasoning, representation, and communication.

This situation highlights a gap between 21st-century learning needs and actual teaching practices, particularly regarding the development of students' mathematical thinking skills (Maharani & Kusno, 2023). Therefore, a learning model is needed that focuses not only on outcomes but also on students' thinking processes. One alternative that can be used is the Canva based Project Based Learning (PjBL) model, which provides students with the opportunity to learn through projects, exploration, and more concrete visual representations of mathematical concepts (Pti et al., 2025). This model is expected to increase students' active engagement while developing their mathematical thinking skills more systematically in the area of plane figures at the Madrasah Tsanawiyah level.

In light of this gap, this study focuses not only on the final learning outcomes but also on the learning process and changes in students' mathematical thinking skills before and after the implementation of the model (Aisa et al., 2021). The novelty of this study lies in the integration of PjBL with Canva, which is used not only as a visualization tool but also as a means of concept construction through project activities that encourage students to build mathematical understanding actively and meaningfully (Pratama & Lestari, 2020). Based on the above description, the research questions in this study are: (1) how is the Canva-based Project Based Learning (PjBL) model implemented in mathematics instruction on the topic of plane figures at MTs Nurul Hasan, and (2) Is there a significant difference in mathematical thinking skills between students who learn using a Canva-based Project-Based Learning (PjBL) model and those who learn through conventional instruction. In line with these research questions, this

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study aims to (1) describe the implementation of the Canva-based Project Based Learning (PjBL) model in mathematics instruction, and (2) to analyze the differences in mathematical thinking skills between students who learn using a Canva-based Project-Based Learning (PjBL) model and students who learn through conventional instruction.

Method

Research Design

This study employs a quantitative approach to analyze changes in students' mathematical thinking skills following the implementation of the learning model (Pandiangan & Albina, 2025). The data collected consist of pre and post-test scores, which were analyzed using statistical techniques. The research design employed was *a quasi-experimental design* with a Nonequivalent Control Group Design (Selvira & Albina, 2025). This design involved two groups: an experimental class and a control class, each of which was administered a pretest to assess students' initial abilities. Next, the experimental class was given treatment in the form of learning using the Canva-based Project Based Learning (PjBL) model, while the control class was given conventional learning. After the learning process was completed, both groups were given a posttest to determine changes in students' mathematical thinking skills.

This design was used to analyze differences in students' mathematical thinking abilities between the treatment group and the control group. Although it did not employ full subject randomization, the quasi-experimental design still provides a stronger indication of the treatment's effectiveness compared to a pre-experimental design, as it involves a comparison group in the analysis process. An overview of the research design used is presented in Table 1.

Table 1. Research Design

Group	Pre-Test	Treatment	Pre-Test
Experimental	O_1	X	O_2
Control	O_1	X_2	O_2

Note:
O_1 : Pre-test of students' mathematical thinking skills before the treatment
O_2 : Post-test of students' mathematical thinking skills after the intervention
X_1 : Teaching mathematics using a Canva-based Project Based Learning (PjBL) model for two dimensional shapes
X_2 : Mathematics instruction using a conventional model without special treatment

A comparison of *pretest* and *posttest* results between the two groups was used to identify improvements in students' mathematical thinking skills, both within each group and between groups. Thus, this design allowed the researcher to analyze differences in learning outcomes more comprehensively and to assess the effectiveness of implementing the Canva-based Project Based Learning (PjBL) model in mathematics instruction. Although this study employed a quasi-experimental design with a control group, it still has limitations regarding the control of external variables that may influence student learning outcomes. Therefore, the results of this study cannot be fully interpreted as a purely causal relationship but rather as an indication of the effect of the treatment administered.

Population and Sample

The subjects of this study were seventh-grade students at MTs Nurul Hasan Maron Probolinggo for the 2025/2026 academic year, consisting of two classes: Class VII A as the control group and Class VII B as the experimental group, each with 20 students. The research sample was determined using the *purposive sampling* technique (Salmawati, 2022). The selection of the two classes was based on considerations of the students' initial ability parity as well as recommendations from subject teachers, so that both groups were considered to have relatively comparable characteristics before the treatment was administered. The experimental class was given a treatment in the form of learning using the Canvabased Project Based Learning (PjBL) model, while the control class followed learning with a conventional approach. The selection of these two groups aimed to obtain a more objective comparison in analyzing differences in students' mathematical thinking abilities after the implementation of the learning model.

Instruments

Data collection in this study was conducted using several techniques, namely observation, documentation, and the test (Yasinta et al., 2020). Observation was used to monitor the implementation of instruction in the experimental and control classes. In the experimental class, observation focused on the application of the Canva-based Project Based Learning (PjBL) model, while in the control class, it focused on conventional learning. The aspects observed included student activities, engagement in discussions, the ability to convey ideas, and participation in solving mathematical problems. Documentation was used as a supporting technique to obtain administrative data and evidence of research implementation, such as student lists, learning materials, and documentation of activities during the learning process. The primary instrument in this study was a mathematical thinking skills test administered in the form of five open-ended questions. The test was conducted in two stages: *a pretest* to determine students' initial ability and *a posttest* to measure their final ability after the intervention was administered (Lukman et al., 2023). The questions were designed based on indicators of mathematical thinking ability, which include conceptual understanding, problem solving, mathematical connections, reasoning, and mathematical communication.

Assessment was conducted using a scoring rubric with a score range of 0–4 for each item, resulting in a maximum score of 20. The scores obtained were then converted to a scale of 0–100 to facilitate the interpretation of results. The assessment process took into account the accuracy of concepts, the completeness of the solution steps, and the clarity of the mathematical arguments presented by the students. The validity of the instrument in this study was tested through *expert judgment* involving mathematics education experts and mathematics teachers (Hastari et al., 2023). The assessment results indicated that the instrument was deemed suitable for use with some revisions to the wording of the questions to better align with the indicators of mathematical thinking skills. The reliability of the instrument was analyzed using Cronbach's Alpha coefficient with the aid of SPSS; a value of $\geq$ 0.60 indicates that the instrument falls into the reliable category and can be used for research data collection.

The test instrument in this study was designed to measure students' mathematical thinking skills, which require not only procedural skills in calculating area and perimeter but also reasoning skills, conceptual connections, and mathematical communication. However, some test items still focus on procedural problem-solving, so the measurement of higher-order thinking skills is not yet fully optimal, and this constitutes one of the limitations of the instrument in this study. The test items administered in this study are shown in Table 2

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Table 2. Mathematical Thinking Ability Test Instruments

Instruments	Descriptions
#1. In her backyard, Rani wants to build a stand for her flower pots so they look neat and are easy to clean. The stand will be made of wooden planks and designed as a square so that all sides are the same length. After measuring, Rani determined that the length of each side of the pot stand is $12\ cm$. a. Explain why the stand is a square by listing its properties. b. Determine the area of the flower pot stand that Rani made.	Students are asked to determine the area and perimeter and explain the concepts used
#2. Andi's school is going to install new carpet in the classroom so that students can study more comfortably. The classroom floor is rectangular. The length of the classroom is $8\ meter$, while the width is $6\ meter$. The carpet purchased must cover the entire floor without any gaps. a. Determine the area of the carpet needed to cover the entire floor. b. Determine the perimeter of the classroom floor. c. Explain the steps you took to solve the problem in a logical sequence.	Students solve contextual problems related to the area and perimeter of two-dimensional shapes in everyday life
#3. A small park in a residential neighborhood has a triangular-shaped gate roof ornament. The base length of the roof is $10\ meter$ and its height is $6\ meter$. The park manager wants to know the area of the roof section to be painted in order to estimate the amount of paint needed. a. Calculate the area of the gate roof. b. Explain the connection between the concept of the area of a triangle and the concept of the area of a rectangle that you have learned previously.	Students are asked to connect the concepts of two dimensional shapes to real-life situations or other mathematical concepts
#4. There is a circular fish pond on the school grounds. A school staff member wants to clean the bottom of the pond and needs to know the surface area of the pond so the work can be done efficiently. After measurement, the pond has a diameter of $14\ meter$. a. Determine the area of the fish pond's base. b. Explain the reasoning behind each step of your calculation until you reach the final result.	Students organize their solution steps systematically and logically to determine the solution
#5. In preparation for a traditional games competition, Budi made a kite out of colored paper. The kite has two diagonals that intersect at right angles, with the length of the first diagonal being $30\ cm$ and the length of the second diagonal being $20\ cm$. In order to decorate the kite properly, Budi needs to know its surface area. a. Calculate the area of the kite. b. Write your solution clearly, step-by-step, and using the correct mathematical symbols.	Students communicate their solutions using appropriate language, symbols, and mathematical notation

Collection

The data collection process in this study was conducted through structured stages in the experimental and control classes. The initial stage began with administering a pretest to both groups to determine the students' initial mathematical thinking abilities before the intervention was implemented. In the experimental class, instruction was conducted using a Project Based Learning (PjBL) model based on Canva (Manueke et al., 2025). The learning process began with the presentation of fundamental questions to introduce problems related to the topic of twodimensional shapes. Next, students work in groups to plan projects, create two-dimensional shape designs using the Canva application, and solve problems related to the concepts of area and perimeter. During the learning process, the teacher acts as a facilitator who provides guidance and monitors student activities. The learning activity concludes with a presentation of project results, as well as reflection and evaluation of the learning process that has taken place. In the control class, instruction was conducted using conventional methods that focused on teacher-led explanations and problem-solving exercises without the application of the Canva-based Project Based Learning (PjBL) model. During the learning process in both classes, observations were conducted to monitor student engagement, learning activities, and the implementation of instruction as supporting research data. In the final stage, both groups were administered a posttest to measure mathematical thinking skills following the intervention. Additionally, documentation was collected to strengthen the research data.

Analysis

The research data was analyzed quantitatively based on the *pretest* and *posttest* scores of students' mathematical thinking skills in the experimental and control classes. The scores obtained from the test results were calculated using an assessment rubric and then converted to a 0–100 scale to facilitate interpretation. Before hypothesis testing was conducted, the data were first tested for statistical assumptions. The normality test was performed using the Shapiro-Wilk test with a significance level of 0.05 (Wara et al., 2025). The data is considered normally distributed if the significance value is greater than 0.05. Next, a test for homogeneity of variance is performed using Levene's test to ensure that the variances between the two groups are equal. The data is considered homogeneous if the significance value is greater than 0.05.

Hypothesis testing was conducted using an *independent samples t-test* to determine differences in mathematical thinking skills between students in the experimental and control classes after the intervention was administered (Kusumawardani & Dewi, 2022). To complement the analysis, *N-gain* calculations were performed to determine the extent of improvement in students' mathematical thinking skills following the instruction. The *N-gain* values were then categorized into high, moderate, and low criteria (Rismayanti & Sukirwan, 2022). In addition, the effect size was calculated using Cohen's *d* formula to determine the magnitude of the impact of the treatment administered (Samo et al., 2023). This analysis aims to provide a more comprehensive picture, so that the research results not only demonstrate statistical significance but also the strength of the effect of implementing the learning model. The interpretation of the results is conducted within the context of learning and is not intended to draw absolute causal conclusions.

Research Findings

This study was conducted at MTs Nurul Hasan with 20 seventh-grade students as the research subjects. This class was selected as the experimental group, which received instruction using a Canva-based Project Based Learning (PjBL) model on the topic of plane figures. The selection of this class aimed to evaluate the implementation of the instructional approach and to determine differences in students' mathematical thinking skills before and after the intervention. The learning process took place over three sessions. In the initial phase, students took a pretest to assess their baseline skills. Next, the teacher presented the core material and introduced project-based learning using Canva. In the following session, students worked in groups to design and develop projects related to two-dimensional shapes. Throughout this process, students were actively engaged in discussions and problem-solving, while the teacher acted as a facilitator. In the final session, students presented the projects they had created, followed by a post-test to assess the final learning outcomes. Before further testing was conducted, the research data were analyzed using descriptive statistics to obtain an overview of the mathematical thinking abilities of students in the experimental and control classes, both before and after the intervention. The results of the analysis are presented in Table 3.

Table 3. Descriptive Statistics of *Pretest* and *Posttest* Results for Mathematical Thinking Skills

Class	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Control Pretest	20	40	60	49.00	5.758	33.158
Posttest Control	20	55	85	68.00	7.847	61.579
Experimental Pretest	20	35	60	47.00	6.767	45.789
Posttest of the Experiment	20	65	100	84.25	10.036	100.724
Valid N (listwise)	20					

Based on Table 3, the average initial ability of students in the experimental class was 47.00, while that of the control class was 49.00. This indicates that the initial abilities of both groups were relatively comparable before the intervention was administered. After the learning process, an improvement was observed in both groups. The average posttest score for the experimental class increased to 84.25, while that of the control class increased to 68.00. This improvement indicates a more optimal upward trend in the experimental class compared to the control class.

When viewed from the standard deviation, the experimental class showed an increase in score variation on the posttest, indicating heterogeneity in student ability after learning. This suggests that the improvement in ability was not uniform but was distributed across various levels of student ability. In general, both groups showed an improvement in mathematical thinking skills; however, the improvement in the experimental class was greater than that in the control class. Therefore, it can be concluded that instruction in the experimental class had a more effective impact on improving students' mathematical thinking skills. Before testing the hypotheses, the data were first tested for normality using the Shapiro-Wilk test. The results of the normality test are presented in Table 4.

Table 4 Results of the *Shapiro–Wilk* Test for *Pre-* and *Post-Test* Mathematical Thinking Skills

Data		Shapiro - Wilk		
		Statistic	df	Sig.
Value	Control Pretest	.922	20	.107
	Posttest Control	.948	20	.336
	Experimental Pretest	.949	20	.347
	Posttest Experimental	.958	20	.502

Based on Table 4, the results of the normality test using the Shapiro–Wilk test showed that the significance values for all data—both pretest and posttest—in the control and experimental classes were above 0.05. The significance value for the control group's pretest was 0.107 and for the posttest was 0.336, while for the experimental group, the significance value for the pretest was 0.347 and for the posttest was 0.502. These results indicate that all data are normally distributed, thus meeting the assumptions for the use of parametric statistical analysis. Thus, the research data is suitable for proceeding to the hypothesis testing stage using parametric tests. Furthermore, after the data were confirmed to be normally distributed, a homogeneity test was conducted to ensure the equality of variances across groups. This test is one of the prerequisites for the use of parametric statistical analysis. The homogeneity test was performed using Levene's test with the assistance of IBM SPSS software version 22. The test results are presented in Table 5.

Table 5. Results of *the Levene Test* for Homogeneity of Variances in Mathematical Thinking Ability

		Levene Statistic	df1	df2	Sig.
Class	Based on Mean	2.713	3	76	.051
	Based on Median	2.238	3	76	.091
	Based on Median and with adjusted df	2.238	3	65.448	.092
	Based on trimmed mean	2.637	3	76	.056

Based on Table 5 of the Levene test results, all significance values obtained are above the 0.05 threshold. The significance values for the mean approach were 0.051, for the median 0.091, for the median with adjusted degrees of freedom 0.092, and for the trimmed mean 0.056. These findings indicate that there were no significant differences in variance between the compared groups. Based on the decision-making criteria, the data are considered homogeneous if the significance level is greater than 0.05. Therefore, it can be concluded that the variance in mathematical thinking ability among students in the control and experimental groups is homogeneous. The fulfillment of this assumption indicates that the data meet the requirements to proceed to the hypothesis testing stage using a parametric test, specifically the *independent samples t-test*. To determine the significance of the difference in mathematical thinking ability between the experimental and control groups, a test was conducted using *the independent samples t-test*. The results of the analysis are presented in Table 6.

Table 6. Results of the *Independent Samples t-Test* for Mathematical Thinking Ability

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Results	Equal variances assumed	1.724	.197	-5.704	38	.000	-16.25000	2.84871	-22.01691	-10.48309
	Equal variances not assumed			-5.704	35.911	.000	-16.25000	2.84871	-22.02794	-10.47206

Based on Table 6, the results of *the Independent Samples Test* show a Levene's test significance value of 0.197 ($p > 0.05$), indicating that the variances of the two groups are homogeneous. Therefore, the t-test analysis *assumes equal variances*. The t-test results show a significance value of 0.000 ($p < 0.05$), indicating a significant difference between the mathematical thinking abilities of students in the experimental group and the control group.

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The *mean difference* of 16.25 indicates that the average ability of students in the experimental class is higher than that of the control class; therefore, the null hypothesis is rejected and the alternative hypothesis is accepted.

To assess the extent of improvement in ability, an analysis was conducted using the NGain index. The results showed that the experimental class achieved a score of 0.70, which falls into the high category, while the control class scored 0.37, placing it in the moderate category. These findings indicate that the improvement in mathematical thinking ability in the experimental class was more significant. Additionally, the effect size was calculated to be 1.81. Based on Cohen's criteria, this value falls into the large category, with interpretation thresholds of 0.2 (small), 0.5 (moderate), and 0.8 (large). A value well above the 0.8 threshold indicates that the implementation of the Canva-based Project Based Learning (PjBL) model has a very strong practical impact on improving students' mathematical thinking skills.

Discussion

The findings of this study indicate that the implementation of a Canva-based Project Based Learning (PjBL) model improves students' mathematical thinking skills. This is evidenced by an increase in the average pretest score from 47 to 84.25 on the posttest in the experimental class, while the control class increased from 49 to 68. The results of the Independent Sample t-test also showed a significance value of 0.000 ($p < 0.05$), indicating a significant difference between the two groups. Furthermore, the N-Gain score in the experimental class was 0.70 (high category), which was higher than that of the control class at 0.37 (moderate category), and the effect size was 1.81, which falls into the large category.

This improvement can be explained through the learning stages in the PjBL model. During the problem-presentation stage, students are guided to understand contextual problems related to two-dimensional shapes, thereby encouraging the process of identifying initial concepts. During the project planning and implementation stages, students use Canva to create visual designs of two-dimensional shapes that help them represent the concepts of area, perimeter, and the properties of shapes more concretely. This process contributes to the improvement of mathematical representation skills. These results are consistent with constructivist theory, which states that knowledge is constructed through active learning experiences (Suryana et al., 2022). In Project Based Learning, students are directly involved in the process of exploration and problem-solving, thereby enabling the development of a deeper understanding. This improvement in ability is also relevant to the indicators of mathematical proficiency according to the NCTM, particularly in the areas of problem-solving and mathematical communication (Lubis & Rahayu, 2023).

During the learning process, students demonstrate stages of mathematical thinking that include *specializing, generalizing, conjecturing,* and *convincing* (Oktaviani & Hanifah, 2025). From a cognitive perspective, this reflects the development of analytical skills, particularly in identifying relationships and formulating problem-solving strategies. The use of Canva as a learning medium supports this process through visual presentations that help students understand the concepts of plane figures more concretely and increase their motivation to learn (Taufiq et al., 2020). Although there were initial challenges in using the technology, students generally adapted well. The learning process became more active, interactive, and collaborative. Thus, the implementation of the Canva-based Project Based Learning (PjBL) model not only improved learning outcomes but also created a more meaningful learning experience and fostered the optimal development of mathematical thinking skills (Fitrini et al., 2025).

Furthermore, group discussions during project completion encourage students to present ideas, provide reasons, and respond to their peers' opinions, thereby developing their mathematical communication skills (Rima et al., 2022). During the presentation stage , students explain their project results systematically and logically, which trains their mathematical reasoning and argumentation skills. Thus, each stage of PjBL contributes directly to the development of students' mathematical thinking skills. When examined in terms of mathematical thinking indicators, the most significant improvement occurred in the areas of problem-solving and mathematical communication, as evidenced by students' ability to formulate a step-by-step solution process and explain their results more clearly than before the implementation (Mardiyanti, 2020). However, in the area of reasoning, some students still struggled to provide more in-depth arguments.

The results of this study are consistent with previous research showing that the Project Based Learning (PjBL) model can enhance students' mathematical thinking skills through active engagement in problem-based learning processes (Jenita et al., 2026). However, this study makes an additional contribution through the use of Canva, which serves not only as a visual medium but also as a tool for representing and organizing students' mathematical ideas. Nevertheless, these findings are still limited to a quasi-experimental research design with a relatively small sample size, so generalizing the results requires caution. Future research is recommended to use a larger sample and a stronger experimental design so that the results obtained can be more comprehensive.

Conclusion

Based on the research findings, it can be concluded that there is a difference in the mathematical thinking skills of seventh-grade students at MTs Nurul Hasan before and after the implementation of the Canva-based Project Based Learning (PjBL) model on the topic of plane figures. This is indicated by an increase in the average score from 47 on the pretest to 84.25 on the posttest in the experimental class, as well as the results of the Independent Sample t-test with a significance value of 0.000 ($p < 0.05$). Furthermore, an N-Gain value of 0.70 (high category) and an effect size of 1.81 indicate a fairly strong improvement in students' mathematical thinking skills. Nevertheless, this study employed a quasi-experimental design with limitations regarding sample size and scope; therefore, the results should be interpreted as differences and trends in the improvement of mathematical thinking skills rather than as a fully absolute causal relationship. Consequently, future research is recommended to include a larger sample and employ a more robust experimental design so that the findings can be generalized more effectively.

Conflict of Interest

The authors declares that there is no conflict of interest.

Auhor Contributions

The first author, N.A., conceived the research idea, designed the study, and collected and analyzed the data. The second author, P.R., contributed to the development of the theoretical framework, the formulation of the methodology, and the data analysis. The third author, A.Z.Z., contributed to the discussion of the research results, manuscript editing, and final revisions. All authors confirm that they have read and approved the final version of this paper. The total percentage of contributions to the conceptualization, drafting, and refinement of this paper are as follows: N.A.: 50 % , P.R.: 30%, and A.Z.Z.: 20%

Data Availability Statement

The authors declare that data supporting the results of this study will be provided by the corresponding author, [N.A], upon reasonable request.

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