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Scratch-Assisted Issue, Discussion, Establish, and Apply (IDEA) Learning Model to Improve Students' Problem-Solving Skills Evaluated from Their Curiosity

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ABSTRACT

The purpose of this study was to test the effectiveness of scratch-assisted Issue, Discussion, Establish, and Apply (IDEA) learning in improving problem-solving skills and to describe problem-solving skills in terms of curiosity. The research method used was a mixed method with a sequential explanatory design and experimental research design using a pretest-posttest control group design. Subjects were taken as many as 6 research subjects based on the level of curiosity using purposive sampling techniques in class VII students of SMP Negeri 1 Toroh in the 2024/2025 academic year. Quantitative data analysis includes normality and homogeneity tests, actual completeness limit completeness tests, classical completeness tests, proportion difference tests, and significant increase tests. Qualitative data analysis includes data reduction, data presentation, and conclusion. The results of this study indicate that (1) mathematics learning using the scratch-assisted Issue, Discussion, Establish, and Apply (IDEA) model is effective in improving problem-solving skills, (2) there is an influence between curiosity and students' mathematical problem-solving skills of 63.2%, (3) subjects with a high curiosity category can meet all indicators of problem-solving skills; subjects with a moderate curiosity category were only able to meet three indicators of problem-solving ability; subjects with a low curiosity category were only able to meet two indicators of problem-solving ability.

***Keywords*:** *Curiosity, IDEA, Problem Solving Skills, Scratch*

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INTRODUCTION

The rapid development of technology and information in the 21st century has had a significant impact on various aspects of life, including in the world of education. In this era of globalization, students are faced with more complex challenges compared to previous generations. They are not only required to master academic knowledge but also must have relevant skills to face the dynamics of life that are constantly changing. The 21st-century skills,

such as critical thinking, creativity, communication, and collaboration, are crucial for every individual to compete in the global market (Kivunja, 2015; Binkley et al., 2012). In the context of education, problem-solving skills are one of the skills that are very much needed (Shodikin et al., 2021). According to the Partnership for 21st Century Skills (2009), problem-solving skills not only function to solve mathematical problems but also to provide innovative solutions to global challenges faced by society. However, the results of initial observations at SMP Negeri 1 Toroh showed that although students had a good conceptual understanding of mathematical material, they still had difficulty in applying this knowledge to solve problems. The average mathematics test score showed that 65% of students were below the established achievement criteria, which was 70. This indicates that there is an urgent need to develop learning methods that can improve students' problem-solving abilities.

This study focuses on the application of the Issue, Discussion, Establish and Apply (IDEA) learning model assisted by Scratch in improving students' mathematical problem-solving abilities at SMP Negeri 1 Toroh. The IDEA learning model is designed to encourage students to be active in the learning process so that they can build knowledge independently through discussion and collaboration. The use of Scratch as a learning medium is expected to make the learning process more interesting and interactive so that it can increase student motivation and learning outcomes (Hardiansyah et al., 2023).

Before conducting this study, the researcher conducted initial observations of the mathematics learning process at SMP Negeri 1 Toroh. The results of the observation showed that although students had a good understanding of mathematical concepts, they still had difficulty applying these concepts to solve problems. Students' difficulties in applying mathematical concepts are influenced by factors such as less interactive learning methods, low curiosity, and lack of systematic problem-solving strategies. Lack of contextual understanding, students tend to memorize formulas without understanding when and how to apply them in real situations. Therefore, this study aims to explore the effectiveness of the Scratch-assisted IDEA learning model in improving students' mathematical problem-solving abilities, as well as to determine the effect of curiosity on these abilities. Using the Issue, Discussion, Establish, and Apply (IDEA) Learning Model has advantages that can increase learning interest, conceptual understanding, and creativity, and create a fun learning atmosphere. This is due to the learning method that uses issues, discussions, proofs, and applications that can help students understand mathematical concepts better.

Various studies show that innovative learning models can improve students' problem-solving abilities. Setiawan & Mustangin (2020) found that the application of the IDEA learning model can significantly improve mathematical problem-solving abilities. In addition, the use of technology-based learning media, such as Scratch, has also been shown to be effective in increasing student motivation and learning outcomes (Hardiansyah et al., 2023). The use of Scratch has also proven effective in improving problem-solving skills (Erol & Çırak, 2022). Students' curiosity also plays an important role in the learning process. Hadiat & Karyati (2019) shows that there is a positive relationship between curiosity and students' mathematical abilities. Thus, this study will examine the relationship between curiosity and mathematical problem-solving abilities in the context of learning with the Scratch-assisted IDEA model.

Designing interesting and creative mathematics is very important to motivate and increase student interest. In today's learning era, teachers must utilize the right technology to improve students' abilities (Ekawati et al., 2024; Erol & Çırak, 2022; Dewi & Rini, 2023). Students can utilize the Scratch platform online (Erol & Çırak, 2022; Rossiter, 2024). The Scratch application greatly supports improving students' problem-solving abilities. Research conducted using the Scratch application has shown that the use of this application can improve learning outcomes and student motivation (Hardiansyah et al., 2023).

Scratch is a block-based visual programming language for introducing basic programming concepts in an interactive and fun language. The advantage of Scratch compared to other learning media is that Scratch can involve students actively and independently. Based on the results of interviews conducted at SMP Negeri 1 Toroh, the teacher explained that learning using learning media was less effective because the location of the school made it difficult to access the internet, the lack of enthusiasm for learning among students, and the limited media available at the school. According to (Kwon et al., 2018), scratch has proven to be suitable for use in learning.

In addition to the learning model and learning media, students' curiosity is very important in mathematics learning. Curiosity can motivate students to find out more about mathematical concepts (Anugrah et al., 2023; Dewi & Rini, 2023). Curiosity can also help students develop problem-solving skills (Susanti, 2020). Students with high curiosity are more involved in group discussions, collaborations, and other active learning activities. According to several studies, there is a positive relationship between students' curiosity and students' mathematical abilities (Hadiat & Karyati, 2019). One way to increase students' curiosity is to use challenging, interactive, and varied learning methods, such as guided discovery (Sari, 2016), Fostering Communities of Learners, or inquiry. These methods can provide opportunities for students to explore, discover, and share mathematical knowledge with fellow students and teachers. This study aims to address the problem of low problem-solving skills through the innovation of the Scratch-assisted IDEA model, while also examining the role of curiosity. The results complement previous findings by proving that the integration of technology and collaborative learning models can improve learning outcomes in schools.

METHODS

This study used a mixed method with a sequential explanatory design. The sample used consisted of 32 students of class VII E (experimental class) and class VII C (control class). For qualitative research, the subjects taken were 6 students from the experimental class. The data used included the results of students' problem-solving ability tests in the form of written answers, student curiosity questionnaire data, and interview results related to the answers given during the problem-solving ability test.

The research process began by providing problem-solving ability test questions, followed by students filling out the curiosity questionnaire. After students worked on the problem-solving ability test questions and filled out the curiosity questionnaire, students' work was analyzed quantitatively and qualitatively so that it could be seen how students' problem-solving abilities

were reviewed from curiosity in the Issue, Discussion, Establish, and Apply (IDEA) model assisted by scratch.

There were 4 problem-solving ability test questions and 20 questions on the curiosity questionnaire. The questions were tested after obtaining approval from the supervising lecturer, validator lecturer, and two mathematics subject teachers at SMP Negeri 1 Toroh. The validation results stated that the questions were suitable to be tested on students. The data collection techniques used in this study were problem-solving ability tests, curiosity questionnaires, and interview guidelines. Interview data were in the form of students' oral answers to questions related to problem-solving ability tests that had been worked on in algebra material.

The data obtained were studied to determine the effectiveness of the Issue, Discussion, Establish, and Apply (IDEA) model assisted by scratch on problem-solving ability and to describe how problem-solving ability is reviewed from a sense of curiosity. Quantitative data analysis techniques by conducting quantitative data prerequisite tests (normality tests and homogeneity tests), actual completeness limit completeness tests, classical completeness tests, average difference tests, and proportion difference tests, by utilizing SPSS 20 software in this study. Analysis of problem-solving ability reviewed from a sense of curiosity using data reduction, data presentation, and conclusion. The data reduction stage was carried out by correcting the answers to the problem-solving ability test and curiosity questionnaire and then grouping students based on their level of curiosity. The data presentation stage was carried out by presenting data based on problem-solving ability indicators. The conclusion-drawing stage was carried out by analyzing and describing the results referring to problem-solving ability indicators. Indicators of problem-solving ability according to NCTM (2000) indicators for measuring students' mathematical problem-solving include: (1) identifying known elements, those asked about, and the scope of required elements, (2) formulating problems into a mathematical model, (3) applying strategies to solve the given problems, (4) explaining the results obtained by the initial problem, and (5) using mathematics meaningfully.

RESULTS AND DISCUSSION

Analysis of Quantitative Methods

Table 1. Quantitative Analysis Results

Test Name	Hypothesis	Sig value	Conclusion
Normality Test	H_0: normally distributed H_1: not normally distributed	Experimental class: 0,162 Control class: 0,200	H_0 accepted
Homogeneity Test	H_0: homogeneous data H_1: non-homogeneous data	0,562	H_0 accepted
Classical Completion Test	H_0: experimental class completion $< 75\%$ H_1: experimental class completion $\geq 75\%$	$z_{count} = 2{,}02$	H_0 rejected
Mean Difference Test	H_0 : average value of experimental class $\leq$ control class H_1 : average value of experimental class $>$ control class	$t_{count} = 3{,}38$	H_0 rejected
Proportion Difference Test	H_0: proportion of completion of experimental class $\leq$ control class H_1: proportion of completion of experimental class $>$ control class	$z_{count} = 2{,}82$	H_0 rejected

The description of Table 1 states that the Issue, Discussion, Establish, and Apply (IDEA) learning model assisted by Scratch can improve students' problem-solving abilities. In addition, the use of scratch can be a medium that supports the improvement of problem-solving abilities.

The reason for the effective learning model of Issue, Discussion, Establish, and Apply (IDEA) assisted by scratch on problem-solving abilities is due to the steps in the syntax of Issue, Discussion, Establish, and Apply (IDEA). According to Setiawan & Mustangin (2020), the syntax in the Issue, Discussion, Establish, and Apply (IDEA) learning model assisted by scratch includes the first phase, namely the teacher introduces the problem or topic to be studied to students. The issues raised must be relevant to everyday life and interest students. The second and third phases are students discussing in small groups to explore ideas and perspectives related to the problems introduced, followed by a presentation of the results of the discussion to the class to establish a deeper understanding of the concepts and principles underlying the problem. In this step, students are grouped by the teacher in a way that students who do not understand during learning receive more attention from the teacher. The learning provided will be accessed from Scratch. Students in groups also discuss finding as much information as possible through worksheet books or textbooks that they have so that they can solve the problems given by the teacher. The second syntax can help students meet the second, third, and fourth problem-solving ability indicators, namely making a solution plan with their versions, implementing a solution strategy to solve mathematical problems, and interpreting the results of solving the problem by providing conclusions from the problem. This is because in this syntax, students who have been given problems begin the problem-solving process by looking for solution steps from Scratch they have. Students have also explained how the steps to solve the learning that has been obtained. The steps to solve them are of course by each method of the material provided. After students have carried out the steps to solve the problem, students also interpret the answers by making conclusions that are by those in the guidebook they have, which means that the fourth step in the problem-solving process has been fulfilled. The fourth phase is the application of the understanding that has been obtained to solve more complex problems or relevant tasks. Students are expected to be able to apply the concepts that have been learned in different contexts. This step encourages students to reflect on the process they have gone through, and the results obtained and discuss how they can use this knowledge in the future.

The application of Issue, Discussion, Establish, and Apply (IDEA) and scratch learning can improve problem-solving skills according to existing research. The Issue, Discussion, Establish, and Apply (IDEA) learning model is a learning model that aims to improve and expand students' conceptual understanding of mathematics material (Fatmawatie et al., 2024). In addition, the use of Scratch-based mathematics learning media optimizes students' problem-solving abilities, thereby increasing their involvement and making learning more enjoyable (Herdiyanti & Yahfizham, 2024).

Analysis of Qualitative Methods

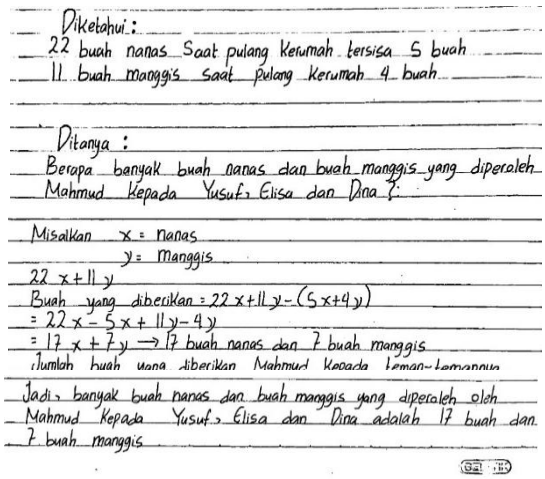
The results of the student curiosity questionnaire data were used to determine the research subjects after implementing learning with the IDEA model assisted by Scratch in Table 2.

Table 2. Curiosity Criteria

Interpretation of Scores	Category	Many Students	Persentase
80-100	*High*	7	23%
60-80	*Medium*	16	52%
0-60	*Low*	9	25%

Problem Solving Ability Reviewed from Curiosity Category High

Students who have high curiosity tend to complete tasks with a systematic approach. This study revealed that curiosity affects students' problem-solving abilities, although other factors may also play a role. The results showed that students with high curiosity achieved good results in problem-solving abilities, namely being able to meet all indicators including understanding the problem, planning a solution, implementing the solution plan, and interpreting the answer. Meanwhile, students with moderate curiosity achieved fairly good results in problem-solving abilities. Furthermore, the results of the analysis of the problem-solving abilities of subjects with a high curiosity category will be presented based on the predetermined indicators in Figure 1.


Diketahui :
22 buah nanas Saat pulang kerumah tersisa 5 buah
11 buah manggis saat pulang kerumah 4 buah

Ditanya :
Berapa banyak buah nanas dan buah manggis yang diperoleh Mahmud kepada Yusuf, Elisa dan Dina ?

Misalkan x = nanas
y = manggis
22 x + 11 y
Buah yang diberikan = 22 x + 11 y - (5 x + 4 y)
= 22 x - 5 x + 11 y - 4 y
= 17 x + 7 y → 17 buah nanas dan 7 buah manggis
Jumlah buah yang diberikan Mahmud kepada teman-temannya

Jadi, banyak buah nanas dan buah manggis yang diperoleh oleh Mahmud kepada Yusuf, Elisa dan Dina adalah 17 buah dan 7 buah manggis

Figure 1. Excerpt of Subject T-1 Answers to Problem Solving Ability Indicators

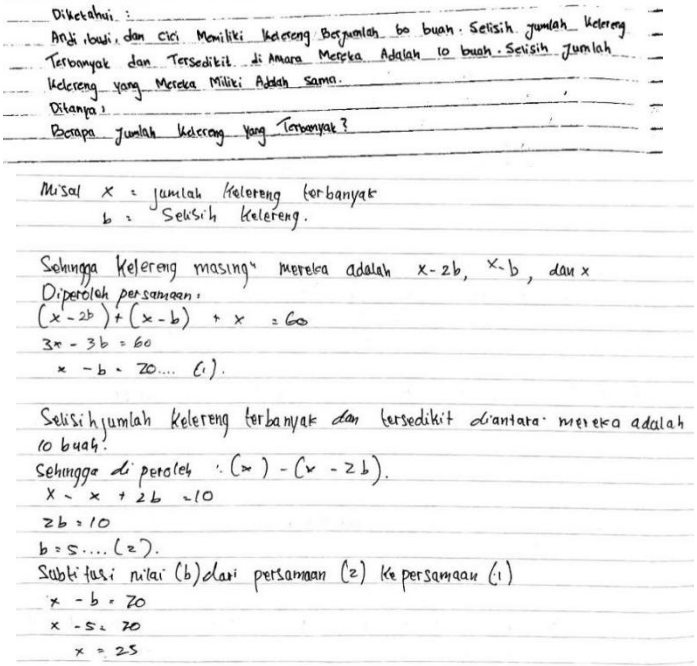
The following is an excerpt from the researcher's interview with subject T-1.

P: "What conclusion can be drawn from the answers provided?"
T-1: "So, Mahmud gave a total of 17 pineapples and 7 mangosteens to his three friends, Sir."

From Figure 1, the answers given by student T-1, we know that the student has written the conclusion correctly and can apply mathematics meaningfully to question number 1. Based on the analysis of problem-solving ability, T-1 has written the solution to question number 1 sequentially. Based on the triangulation above, it can be said that T-1 can fulfill the indicators of problem solving ability (1) identifying the adequacy of elements to solve problems, (2) creating mathematical models from one situation or daily life problem, (3) choosing and implementing strategies for solving both mathematical and non-mathematical problems, (4) describing and interpreting the results of problem solving and checking the correctness of the results, able to fulfill the indicator (5) applying mathematics meaningfully.

Problem Solving Ability Reviewed from Curiosity Category Medium

The results of the work and interviews of students with moderate curiosity levels show that they tend not to be fully able to meet the indicators of problem-solving ability, especially in interpreting answers and drawing conclusions from the problems given. However, in the indicator of understanding the problem, students with moderate curiosity can write down all the information known about the existing problem. In the indicator of making a solution plan, they are also able to design a solution based on the problems given, thus facilitating the problem-solving process. Meanwhile, in the indicator of implementing the solution plan, students with moderate curiosity can solve problems with the right steps. However, in interpreting the results of the solution, they are still not able to conclude properly. Overall, students with moderate curiosity are only able to meet two indicators of problem-solving ability, namely (1) identifying the adequacy of elements to solve problems, (2) making mathematical models of one situation or daily life problem, (3) choosing and applying problem solving strategies for both mathematical and non-mathematical problems, (4) describing and interpreting the results of problem solving and checking the correctness of the results, being able to meet the indicator (5) applying mathematics meaningfully. Next, the results of the analysis of the problem-solving abilities of subjects in the medium category of curiosity will be presented based on the indicators that have been determined in Figure 2.


Diketahui :
Anji ibuai, dan cici Memiliki kelereng Berjumlah 60 buah. Selisih jumlah kelereng Terbanyak dan Tersedikit di Antara Mereka Adalah 10 buah. Selisih jumlah kelereng yang Mereka Miliki Adalah Sama.
Ditanya :
Berapa jumlah kelereng yang Terbanyak ?

Misal x = jumlah kelereng terbanyak
b = Selisih kelereng.

Sehingga kelereng masing" mereka adalah x-2b, x-b, dan x
Diperoleh persamaan :
(x-2b)+(x-b)+x = 60
3x - 3b = 60
x - b = 20.... (1).

Selisih jumlah kelereng terbanyak dan tersedikit diantara mereka adalah 10 buah.
Sehingga di peroleh : (x) - (x - 2b).
x - x + 2b = 10
2b = 10
b = 5.... (2).
Subtitusi nilai (b) dari persamaan (2) ke persamaan (1)
x - b = 20
x - 5 = 20
x = 25

Figure 2. Excerpt of Subject S-1 Answers to Problem Solving Ability Indicators

The following is an excerpt from the researcher's interview with the S-1 subject.

P: "What conclusion can be drawn from the answers provided?"

S-1: "I didn't write a conclusion in answer number 2, sir. Because I was confused and ended up wasting my time."

From Figure 2, the answers given by S-1 students, we know that students have not made conclusions because they tend to focus on question Number 2. Based on the analysis of S-1 problem solving abilities, they have written down the solution to question Number 2 in

sequence even though they have not written a conclusion. Based on the triangulation above, it can be said that S-1 has not fully met the indicators of problem solving abilities (1) identifying the adequacy of elements to solve problems, (2) making mathematical models of one situation or daily life problems, (3) choosing and applying problem solving strategies for both mathematical and non-mathematical problems, (4) describing and interpreting the results of problem solving and checking the correctness of the results, being able to meet the indicator (5) applying mathematics meaningfully.

Problem Solving Ability Reviewed from Curiosity Category Low

The results of the work and interviews of students with low curiosity levels show that they tend to only be able to meet one indicator of problem-solving ability, namely (1) identifying the adequacy of elements to solve problems, (2) making mathematical models of one situation or daily life problem, (3) choosing and applying problem solving strategies for both mathematical and non-mathematical problems, (4) describing and interpreting the results of problem solving and checking the correctness of the results, being able to meet the indicator (5) applying mathematics meaningfully, students with low curiosity have not been able to draw conclusions based on the answers they have given. Overall, students with low curiosity only meet the indicator of understanding the problem, while the other three indicators, namely planning, implementing, and interpreting the results of the solution, have not been met. Furthermore, the results of the analysis of the problem-solving abilities of subjects with a low curiosity category will be presented based on the predetermined indicators in Figure 3.

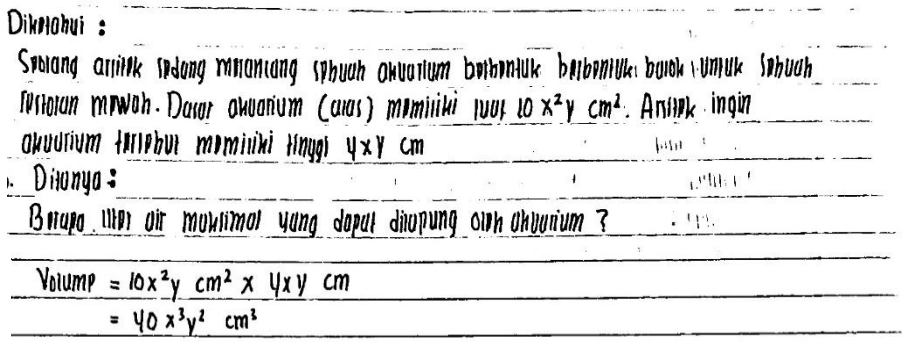

Diketahui :
Seorang arsitek sedang merancang sebuah akuarium berbentuk balokuntuk sebuah restoran mewah. Dasar akuarium (atas) memiliki luas $10x^2y\ cm^2$. Arsitek ingin akuarium tersebut memiliki tinggi $4xy$ cm
Ditanya :
Berapa liter air maximal yang dapat ditampung oleh akuarium ?
Volume = $10x^2y\ cm^2 \times 4xy$ cm
= $40x^3y^2\ cm^3$

Figure 3. Excerpt of Subject R-I's Answers to Problem Solving Ability Indicators

The following is an excerpt from the researcher's interview with subject R-1.
P: "What conclusion can be drawn from the answers provided?"
R-1: "I didn't write any conclusions, Sir."

From Figure 3, the answers given by student R-1 show that they have not made the right conclusions and have not been able to apply mathematics meaningfully to question number 3. Based on the analysis of S-1's problem-solving ability, they have not been able to write down the solution sequentially to conclude. Based on the triangulation above, it can be said that R-1 has not met the indicators of problem-solving ability (1) identifying the adequacy of elements to solve problems, (2) making mathematical models from one situation or daily life problem, (3) choosing and applying problem-solving strategies for both mathematical and non-mathematical problems, (4) describing and interpreting the results of problem solving and

checking the correctness of the results, and being able to meet the indicator (5) applying mathematics meaningfully.

The results of qualitative data analysis show that students with high curiosity tend to have superior problem-solving abilities compared to students with medium and low curiosity. Students with high curiosity can meet all indicators of problem-solving abilities. Meanwhile, students with medium curiosity have a better level of problem-solving abilities compared to students with low curiosity, although not as good as students with high curiosity. Students with medium curiosity can meet the first, second, and third indicators of problem-solving abilities. On the other hand, students with low curiosity tend to have lower problem-solving abilities compared to the other two groups. This can be seen from the results of problem solving obtained by students with low curiosity, which are lower than students with high and medium curiosity.

The above is in line with research by Muharni et al. (2024) which explains that groups of students with high curiosity also have high problem-solving abilities. Based on filling out the questionnaire, students with high curiosity answered questions consistently, indicating that they answered according to themselves. They have high intelligence in turning problems into challenges that are ready to be solved. They can achieve the right answer by formulating each step of problem solving through the appropriate method. Meanwhile, groups of students with moderate curiosity have moderate problem-solving abilities. They have sufficient intelligence to turn problems into challenges but tend to work on problems according to their abilities. When faced with challenges that are too difficult, they tend to feel satisfied and do not try more than they can. On the other hand, groups of students with low curiosity have lower problem-solving abilities than groups with high and moderate curiosity. They tend to give up faster and only work on challenges to the limits of their abilities. Students at this level are not yet able to think further or try to find ways to solve the challenges given. This is in line with the opinion of Hakim & Marzuki (2019) who stated that students who show curiosity tend to ask more questions during the learning process and actively seek information from sources outside of textbooks. Meanwhile, other research states that curiosity about mathematics is not influenced by factors such as gender and academic level (Zetriuslita et al., 2024). In addition, the level of student curiosity can affect their learning outcomes in subjects such as Physics.

CONCLUSION

Based on the results of research and discussion on students' problem-solving abilities reviewed from curiosity with the IDEA model assisted by scratch on the material of class VII SMP N 1 Toroh, it was concluded that the IDEA model assisted by scratch is effective for students' problem-solving abilities. It is shown by the fulfilment of the following learning effectiveness criteria; (1) students' mathematical problem-solving abilities in learning with the IDEA model achieve classical learning completeness; (2) the average mathematical problem-solving abilities of students with the IDEA model using scratch are better than the average mathematical problem-solving abilities of students in IDEA learning; (3) the proportion of completeness of the results of the mathematical problem-solving ability test of students with IDEA learning with the scratch mathematical modelling strategy is more than the proportion of students' problem-solving abilities in classes using IDEA.

The curiosity questionnaire score obtained, students were grouped into three categories, namely 7 students in the high curiosity category, 16 students in the medium curiosity category, and 9 students in the low curiosity group. Then it was concluded that there was an influence between curiosity and students' problem-solving abilities in IDEA learning assisted by scratch of 63.2%. This means that curiosity has an influence of 63.2% on the increase or decrease in mathematical problem-solving abilities and there is still 36.8% due to other factors that were not studied in this study.

The description of students' mathematical problem-solving abilities in IDEA learning assisted by Scratch in terms of curiosity is as follows: (1) Students with high curiosity can understand problems by writing down what is known and asked in the problem, planning solutions with the right steps, implementing the solution plan through accurate calculations, and interpreting the results obtained. (2) Students with moderate curiosity can understand problems by writing down what is known and asked, planning a solution with the right steps, and implementing the solution plan through accurate calculations, but tend to be less able to interpret the answers obtained. (3) Students with low curiosity tend to be able to understand problems by writing down what is known and asked but are not yet able to plan a solution with the right steps, are unable to implement the solution plan, and are unable to interpret the answers obtained.

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