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Mathematical Problem-Solving Skills in View of Self-Efficacy in GeoGebra-Assisted Project-Based Learning

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Abstract. *The research aims to analyze the effectiveness of a project-based learning model assisted by GeoGebra on mathematical problem-solving skills and analyze mathematical problem-solving skills in terms of self-efficacy. The research used a mixed method sequential explanatory design with a pretest-posttest control group design. Sample selection using cluster random sampling. Class VIIIA had 31 students as the experimental class, and class VIIIB had 30 as the control class. Data collection used a self-efficacy questionnaire, interviews, and tests. Quantitative data analysis used the average completeness test, proportion test, mean difference test, proportion difference test, and n-gain test with the help of Rstudio. Data collection, reduction, presentation, and conclusions to analyze qualitative data. The results of the research found that the project-based learning model assisted by GeoGebra was effective on mathematical problem-solving skills, subjects with high self-efficacy were able to fulfill four indicators of mathematical problem-solving skills, medium self-efficacy subjects were only not optimal in the indicator of applying various appropriate strategies to solve problems, and low self-efficacy subjects were only optimal in the indicator of building new mathematical knowledge through problem-solving and solving problems in mathematics or other contexts.*

Keywords: *Mathematical Problem Solving, Project Based Learning, GeoGebra, Self Efficacy*

INTRODUCTION

The main focus in learning mathematics is problem-solving (Skinner & Cuevas, 2023). According to the National Council of Teachers of Mathematics, learning mathematics aims to develop basic mathematical skills, including problem-solving ability (Hidayat et al., 2022). Problem-solving skills are organizing concepts and facts, connecting previously held knowledge, and using reasoning skills to solve problems (Arta et al., 2020). People cannot ignore problem-solving because it is a skill taught and used in mathematics and applies to everyday situations, helping individuals solve their problems. Students must develop mathematical problem-solving skills (Widodo et al., 2021; Rahmah et al., 2022; Fatmasari et al., 2021).

Some research findings show that Indonesian students' problem-solving skills are still relatively low (Noor & Waluya, 2023). The results of the PISA and TIMSS surveys indicate that the mathematical abilities of Indonesian students consistently score below the international average and are ranked at the bottom every year (Masfufah & Afriansyah, 2021). The observations of students at Sudirman 1 Islamic Junior High School in Bancak show that students' average mathematical problem-solving skills in geometry material are still relatively low. Students tend only to remember rather than understand concepts, so they are often confused when connecting information in problems with mathematical concepts. Most students are concerned with the final answer rather than the process of solving problems. Moreover, if the problem differs from the example, it causes students to be uncertain about solving it. When finding things that are not understood, students prefer to remain silent and not dare to ask. This situation has an impact on students' low self-efficacy.

Based on the description above, problem-solving skills and self-efficacy play an important role in achieving learning goals. Fitriani et al (2020) stated that success in tasks and achieving the desired goals requires a sense of confidence and trust in one's abilities. Menurut Putri & Juandi (2022) self-efficacy is a belief in one's ability to master challenges, tasks, and situations. This ability includes mental, motivational, emotional, and behavioral beliefs to achieve specific goals. In addition, according to Bellemans & Devos (2023), self-efficacy is an assessment of how individuals feel that they can perform actions that bring the desired results.

The measurement of student self-efficacy refers to three dimensions, namely 1) Magnitude, related to the level of difficulty of the task; 2) strength, related to the level of student confidence; 3) Generality, related to how students' attitudes in completing tasks (Hendriana et al., 2017). The research results of Septhiani (2022) show that self-efficacy affects problem-solving skills. The significant contribution of self-efficacy to problem-solving ability, which reaches 85%, demonstrates this relationship. Several studies also indicate that self-efficacy is crucial to students' problem-solving success (Mudzakin et al., 2022; Sa'diyah et al., 2024).

Learning activities that can help students strengthen their mathematical problem-solving skills and self-efficacy must be carefully considered. Choosing the right learning model can impact achieving the learning objectives. Project-based learning is one of the available learning paradigms. Project-based learning is a learning model that involves students according to their experiences and abilities in building the solution process through project activities (Sarwi et al., 2021). Cooperation and construction of student knowledge in the project-based learning model are highly emphasized. Previous research shows the potential of project-based learning to improve students' problem-solving skills (Fiteriani et al., 2021; Rezeki et al., 2023; Fatimah et al., 2022; Muwahiddah et al., 2021) and increase students' self-efficacy (Samsudin et al., 2020). Project-based learning encourages students to work together to solve problems by combining construction, application, and understanding (Guo et al., 2020). In addition, project-based learning encourages students to be independent and autonomous. The syntax of project-based learning, according to George Lucas, includes: 1) starting with the essential question, 2) designing the project, 3) creating a schedule, 4) monitoring the students and the progress of the project, 5) assessing the project result, 6) evaluation (Jazuli et al., 2019).

Project-based learning with the assistance of GeoGebra is a technological innovation that helps develop students' thinking frameworks. Previous research on applying project-based learning with GeoGebra positively improved problem-solving skills (Setyaningsih & Rahman, 2023; Sucipta et al., 2018). This research is here to continue the suggestions from the research conducted by Setyaningsih Rahman (2023), namely analyzing other factors that influence problem-solving skills and self-efficacy.

Based on the description above, researchers conducted an innovative experiment focusing on implementing project-based learning assisted by GeoGebra on mathematical problem-solving skills. This study aims to analyze the effectiveness of implementing project-based learning assisted by GeoGebra on mathematical problem-solving skills and analyze mathematical problem-solving skills in terms of students' self-efficacy.

RESEARCH METHOD

The research used a mixed-method sequential explanatory design. Quantitative data collection and analysis were conducted first, followed by qualitative data analysis to expand conclusions. The research design used a pretest-posttest control group design. In this design, cluster random sampling randomly selected two sample groups. VIII A class of 31 students was an experimental class with project-based learning assisted by GeoGebra, while VIII B class of 30 students was a control class with discovery learning. Both classes were given a pretest and posttest. The pretest was used to determine initial ability, while the posttest was used to compare learning outcomes.

The research was conducted at Sudirman 1 Islamic Junior High School in Bancak. The research subjects were selected by purposive sampling. The experimental class self-efficacy category determined the selection. Mathematics education experts further evaluated learning devices to determine the effectiveness of GeoGebra-assisted project-based learning. The data collection techniques used were written tests of problem-solving skills on the surface area of pyramids and prisms, self-efficacy questionnaires, and interviews. According to NCTM (2000) and Sa'diyah et al. (2024) in Table 1 below, students' written test results were confirmed through interviews based on indicators of problem-solving ability.

Table 1. Indicator of Mathematical Problem-Solving Skills

Indicator of Mathematical Problem-Solving Skills	Sub Indicators of Mathematical Problem-Solving Skills
Build new knowledge through problem-solving	Understand and utilize information to solve problems.
Solve problems in mathematics or other contexts	Relate problems to everyday life to determine problem-solving strategies
Apply a variety of appropriate strategies to solve problems	Solve problems with the strategies used or different steps
Monitor and reflect on the problem-solving process	Rechecking the solution results by reviewing the problem-solving process

The mathematical problem-solving skills test questions given to students are as follows:

A student gets an assignment from his math teacher to make a pyramid frame with a rectangular base. The pyramid has length 16 cm, width 12 cm and height 24 cm. If the frame is made of wire, then help the student to determine the length of wire needed!

a. Write down the relevant information and illustrate it on the drawing!
b. Write down the steps to solve the problem!
c. Do the steps that you have written down! Is there any other way? If so, explain!
d. Write down the conclusion and how to check the correctness of the result!

Figure 1. Mathematical Problem-Solving Skills Test

Quantitative data analysis was obtained from pretest and posttest scores with predetermined criteria. Data processing uses the help of Rstudio. Data was tested first using the normality test and homogeneity test. Then, the hypothesis test was conducted, namely the average completeness test, using One Sample T-Test. The classical completeness test of GeoGebra-assisted project-based learning was used to determine the success of experimental class students, which reached more than 75%. The mean difference test (comparative test) was used to determine the difference in the average test scores of mathematical problem-solving skills on project-based learning assisted by GeoGebra with the test scores of mathematical problem-solving skills on discovery learning. The proportion difference test was also used to compare the number of students who achieved mastery between the experimental and control classes. The n-gain test was used to determine the improvement of problem-solving skills and self-efficacy.

Qualitative data analysis was conducted using data collection, reduction, presentation, and conclusions. The interview results went through a reduction process with a tabular presentation. Interview data is then compared with the results of the problem-solving ability test to find out how well students solve problems in connection with their self-efficacy.

RESULT AND DISCUSSION

Learning effectiveness

Before hypothesis testing, the normality prerequisite test is carried out first to determine whether the data is normally distributed. If the data is standard, then hypothesis testing can be done with parametric tests.

```
> pearson.test(NILAI_KPMM$`posttest eksperimen`)

        Pearson chi-square normality test

data:  NILAI_KPMM$`posttest eksperimen`
P = 7.9677, p-value = 0.158

> pearson.test(NILAI_KPMM$`posttest kontrol`)

        Pearson chi-square normality test

data:  NILAI_KPMM$`posttest kontrol`
P = 6.8, p-value = 0.2359
```

Figure 1. Normality Test

Based on the normality test results with the help of Rstuddio Figure 2, it shows the p-value in experimental and control classes> 0.05. This number means that the data is normal. Before testing the average minimum completeness of problem-solving ability, it is necessary to determine the BTA (actual completion limit) first as a reference for the minimum value obtained. The actual due date set in the study was 63.

```
        One Sample t-test

data:  NILAI_KPMM$`posttest eksperimen`
t = 11.134, df = 30, p-value = 1.771e-12
alternative hypothesis: true mean is greater than 63
95 percent confidence interval:
 76.0312      Inf
sample estimates:
mean of x
   78.375
```

Figure 2: Test of Average Completeness

The results of the one-sample t-test with the help of Rstudio in Figure 2 show a p-value of $1{,}701x10^{-12} < 0{,}05$. This number means that the average student score in the GeoGebra-assisted project-based learning class exceeds the average completion limit.

```
R 4.3.1 · ~/
> prop.test(29,31,0.75,alternative="greater",conf.level=0.95)

        1-sample proportions test with continuity correction

data:  29 out of 31, null probability 0.75
X-squared = 4.7419, df = 1, p-value = 0.01472
alternative hypothesis: true p is greater than 0.75
95 percent confidence interval:
 0.8015241 1.0000000
sample estimates:
        p
0.9354839
```

Figure 3. Classical Completeness Test

The test results in Figure 3 show that 29 out of 31 students in the GeoGebra-assisted project-based learning class have exceeded the BTA. 93,5% of students scored more than BTA. Based on the analysis results, the p-value of 0.01472 < 0.05 was obtained. This result means that over 75% of students who received GeoGebra-assisted project-based learning scored above the BTA.

```
        Two Sample t-test

data:  NILAI_KPMM$`posttest eksperimen` and NILAI_KPMM$`posttest ko
ntrol`
t = 2.8719, df = 59, p-value = 0.00283
alternative hypothesis: true difference in means is greater than 0
95 percent confidence interval:
 2.848439      Inf
sample estimates:
mean of x mean of y
  78.3750   71.5625
```

Figure 4: Mean difference test

The average difference test in Figure 4, with the help of Rstudio, obtained a p-value of 0.002811 < 0.05. This result means that the average result of students' mathematical problem-solving skills in project-based learning assisted by GeoGebra is better than that of students' mathematical problem-solving skills in discovery learning.

```
        2-sample test for equality of proportions with
        continuity correction

data:  c(29, 22) out of c(31, 30)
X-squared = 3.1903, df = 1, p-value = 0.03704
alternative hypothesis: greater
95 percent confidence interval:
 0.01801565 1.00000000
sample estimates:
   prop 1    prop 2
0.9354839 0.7333333
```

Figure 5: Proportionality difference test

The proportion difference test in Figure 5 above using Rstudio assistance obtained a p-value of 0.03704 < 0.05. This result means that the proportion of students' mathematical problem-solving skills in project-based learning assisted by GeoGebra is better than in discovery learning—the increase in self-efficacy and mathematical problem-solving ability test in the experimental class in Figure 6.

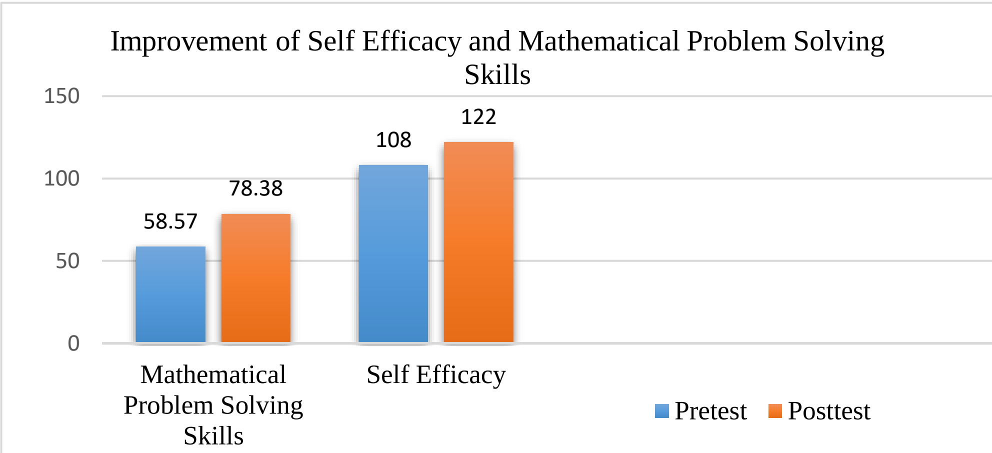

Figure 6. Improvement of Self Efficacy and Mathematical Problem Solving Skills

Based on Figure 6, there is an increase in self-efficacy after GeoGebra-assisted project-based learning. The results of the N-Gain calculation show an increase in self-efficacy of 0,24 in the low category. Furthermore, the N-Gain calculation of mathematical problem-solving skills after GeoGebra-assisted project-based learning is 0,42 in the medium category.

Based on the results of data analysis, project-based learning assisted by GeoGebra can be said to be effective in developing mathematical problem-solving skills. This study's results align with research conducted by Setyaningsih & Rahman (2023) that project-based learning assisted by GeoGebra is effective for improving mathematical problem-solving skills. Project-based learning assisted by GeoGebra allows for an increase in student enthusiasm during learning. Students are enthusiastic and confident in their ability to do projects during learning. Samsudin et al. (2020) research showed that student self-efficacy increased after learning with the project-based learning model.

Description of Mathematical Problem-Solving Skills in Terms of Self-Efficacy

The grouping of high, medium, and low self-efficacy is based on the questionnaire's results in the GeoGebra-assisted project-based learning class. The results of the self-efficacy questionnaire varied in high, medium, and low categories. Data acquisition was performed based on the self-efficacy questionnaire given to 31 students in the following experimental class.

Table 2. Grouping Students Based on Self-Efficacy

Self Efficacy Category	Many students
High	5
Medium	21
Low	5

Based on the data in Table 2, 3 subjects were selected to be interviewed: subject ST with high self-efficacy, subject SS with moderate self-efficacy, and subject SR with low self-efficacy. These subjects were chosen because they were likelier to show good, moderate, and low self-efficacy than other students. In addition, consideration from teachers with criteria: 1) students' ability in mathematics, 2) students' activeness during learning, and 3) students' communication skills orally or in writing so that they can provide complete and precise information according to the objectives expected by the researcher.

High Self-efficacy Mathematical Problem-Solving Skills

The results of the ST answer at point A are as follows:

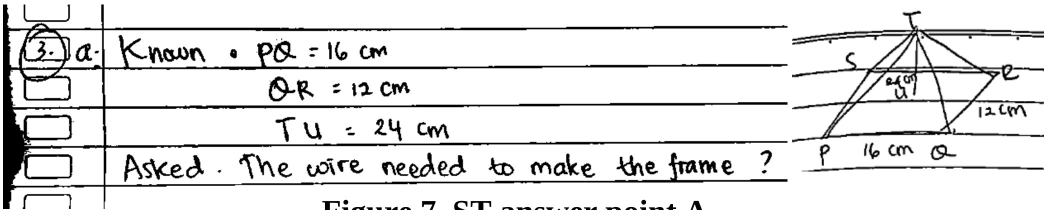

Figure 7. ST answer point A

Based on Figure 7, mathematical problem-solving skills can be analyzed by building new mathematical knowledge through problem-solving, where the subject can understand and utilize information from the problem to create image illustrations. This indicator can be confirmed and explained through the following interview results:

R : "What do you understand from the question?"

ST : "The problem shows a rectangular pyramid with length 16cm, width 12cm, and height 24m. We are told to find the length of the wire to make the frame."

R : "How do you present the problem to the drawing form?"

ST : "I drew a rectangular pyramid with the measurements. PQ, RS is normalized as length, QR, PS as width, and TU as height."

Based on the interview results above, the ST subject understands and utilizes information from the problem to illustrate the drawing form clearly without any errors. The subject uses variable symbols to express each side length of the pyramid, such as PQ and RS to express length, QR and PS to express width, and TU to express height.

The results of the ST answer at point B are as follows:

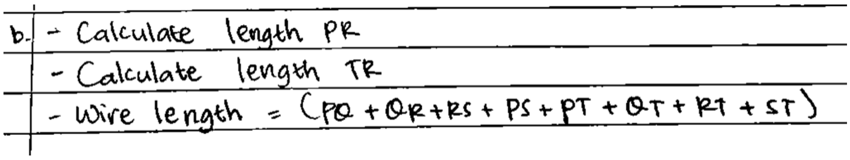

Figure 8. ST answer point B

Based on Figure 8, mathematical problem-solving skills are analyzed using indicators of solving problems in mathematics or other contexts where, in this case, the subject can determine alternative strategies to solve problems. This indicator can be confirmed and explained through the following interview results:

R : "Explain the strategy you will use?"

ST : "First, I find the length of PR first with Pythagoras, then find the TR. So that all the ribs will be known later. Then, calculate the length of the wire by adding up all the rib lengths (PQ+QR+RS+PS+PT+QT+RT+ST)."

Based on the interview results above, ST subject was able to explain the sequence of strategies to be used well to get the proper solution steps. The subject could relate the problem to the material previously learned about the Pythagorean theorem.

The results of the ST answer at point C are as follows:

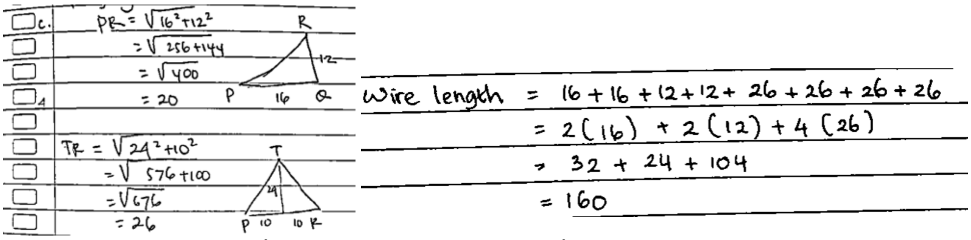

Figure 9. ST answer point C

Based on Figure 9, the indicator of mathematical problem-solving skills analyzed is applying various appropriate problem-solving strategies. Subject ST was able to solve the problem with the plan he made to get the required wire length correctly. This indicator can be confirmed and explained through the following interview results:

R : "Is there any other way other than that?"
ST:" Hmmm, besides that method, I also have another way, mam. First, find the circumference of BD and AE with Pythagoras. So later, the circumference + (4 x upright ribs).

Based on the interview results above, subject ST was able to provide other alternative solutions to solve the problem with the concept of the circumference of the base and the Pythagorean theorem so that the length of the wire can be obtained from the circumference + (4 x upright ribs).

The results of the ST answer at point D are as follows:

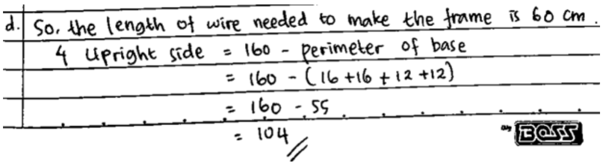
d. So, the length of wire needed to make the frame is 60 cm.
4 Upright side = 160 - perimeter of base
= 160 - (16 + 16 + 12 + 12)
= 160 - 55
= 104

Figure 10. ST answer point D

The problem-solving indicator analyzed in Figure 4 monitors and reflects on the mathematical problem-solving process. Subject ST could reflect by writing conclusions and trying to re-examine the answers obtained. This indicator can be confirmed and explained through the following interview results:

R : "Are you going to recheck your answer?"
ST : "Always, Mom, to be sure."
R : "How do you do that?"
ST : "From the total length 160 - (16 + 16 + 12 + 12) = 104. 104: 4 = 26. That means it is the same. So, I think my answer is correct, but it should not be 55, mom. It should be 56."

Based on the interview results, the ST subject realized the mistakes made, leading to the correct answer. The subject rechecked the results by re-substituting the final answer into the initial formula.

The competence of high self-efficacy students in this study shows extraordinary mathematical problem-solving skills thanks to the inner drive to explore solutions despite facing various challenges. Students are committed to solving problems, can survive in various conditions, and can solve problems with the knowledge they have. Students can develop different problem-solving strategies that other students do not think.

The findings of this study support the statement of Cano et al. (2023) that high self-efficacy students tend to be more successful in finding solutions to complex problems and persevere when facing obstacles. Students with high self-efficacy tend to be more excited about challenging tasks, work harder, and never give up (Septhiani, 2022; Dagdag et al., 2020).

Mathematical Problem-Solving Skills Medium Self-Efficacy

The results of the SS answer at point A are as follows:

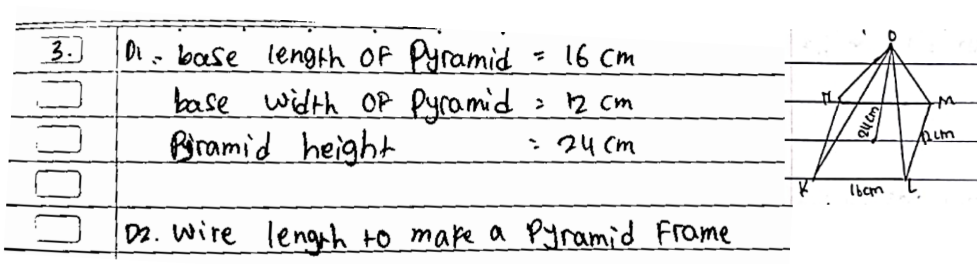

Figure 11. SS answer point A

The mathematical problem-solving skills in Figure 11 can be analyzed with the indicator of building new mathematical knowledge through solving. The subject understood and utilized information from the problem to make the illustration correct. This indicator can be confirmed and explained through the following interview results:

R : "What do you understand from the problem?"

SS : "You know the length of the base of the frame is 16 cm, the width is 12 cm, and the height is 24 cm. The question is the length of the wire to make the pyramid frame."

R : "How do you present the problem to the picture?"

SS : "I named the pyramid KLMNOP, KL, and MN as the length, KN and LM as the width, and OK, OL, OM, and ON as the upright side of the pyramid."

In the interview results above, subject SS could state the information given from the problem. Subject SS wrote the information using his language. The subject can use the information to illustrate the problem in a picture by giving well-variable symbols.

The results of the SS answer at point B are as follows:

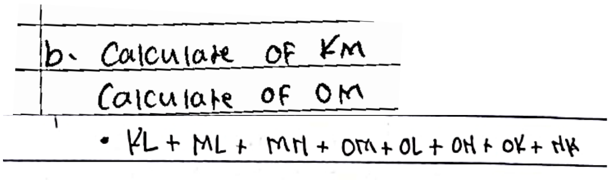

Figure 12. SS answer point B

The mathematical problem-solving skills of Figure 12 were analyzed using the indicator of solving problems in mathematics or other contexts. This indicator shows that the subject can determine alternative strategies to solve problems. This indicator can be confirmed and explained through the following interview results:

R : "Explain the strategy you will use?"
SS : "First, find the length of KM and then OM as the upright side of the pyramid, so KL=MN, LM=KN, OM=ON=OL=OK. Then add it all up, Mom."
R : "Is this problem related to other materials?"
SS : "I think so, mom. Anyway, the material is a right triangle. However, I forgot the name."

The interview results showed that SS subjects could explain the strategy that should be used to get the proper solution steps. Subject SS could relate the solution strategy used with the Pythagorean theorem material.

The results of the SS answer at point C are as follows:

Students experience conceptual errors in the use of the pythagorean theorem

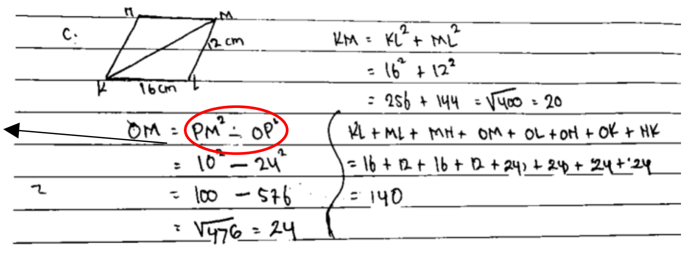

Figure 13. SS answer point C

Based on Figure 13, the indicator of mathematical problem-solving skills analyzed is applying various appropriate problem-solving strategies. Subject SS was able to solve the problem with the plan he made. However, subject SS could not obtain the correct results due to the wrong concept of the Pythagorean theorem

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used. The indicator can be confirmed and explained through the following interview results:

P : "Are you sure that your solution process is correct?"
SS : "I wasn't sure at first, but since I matched my friend's answer, I'm sure."
P : "Is there another way besides what you wrote?"
SS : "I do not know mom

Subject SS could not provide alternative solutions to solve the problem based on the interview results. The subject cannot understand the concept of the Pythagorean theorem well, so the solution results obtained are incorrect.

The results of the SS answer at point D are as follows:

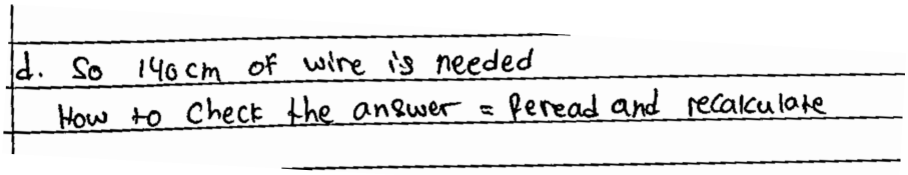

Figure 14. SS answer point D

Mathematical problem-solving ability in Figure 14 is analyzed with indicators of problem-solving skills, namely monitoring and reflecting on the process of solving mathematical problems. Subject SS has been unable to reflect the problem-solving results appropriately due to errors in the mathematical concepts. This indicator can be confirmed and explained through the following interview results:

R : "Did you recheck your answer?"
SS : "Yes, mom."
R : "How did you do it?"
SS : "I reread the question slowly and then calculated again."
R : "Are you sure your answer is correct?"
SS : "Sure, Mom"
R : "Need to check again? If there is a mistake, can you correct it?"
SS : "Just a moment mom. After I read it briefly, I think it is correct."

Based on the interview results, the SS subject rechecked the answers, but the method used was less effective by rereading and checking the calculations. SS subjects monitored the results obtained during the interview less. SS subjects tend to make less effort to solve complex problems.

The results of this study indicate that students with moderate self-efficacy also have a moderate level of problem-solving skills. Indicators of mathematical problem-solving skills that moderate self-efficacy students fulfill are only 3. This is in line with the research of Sa'diyah et al. (2024) that students with moderate self-efficacy are only optimal in three indicators of problem-solving skills.

The medium self-efficacy subjects in this study showed a relatively strong commitment to solving problems but tended to be less confident in their abilities. A lack of solid understanding of mathematical concepts leads students to attempt to complete tasks without proper comprehension, which is detrimental to their learning. The findings of this study are in line with the research of Fatmasari et al. (2021) that students with medium self-efficacy tend to experience conceptual errors when performing problem-solving techniques, so problem-solving is less than ideal. According to Damiani & Afriansyah (2022), students with medium self-efficacy tend to avoid situations when the tasks are complex and try enough to achieve the tasks they can.

Mathematical Problem Solving Skills Low Self-Efficacy

The results of the SR answer at point A are as follows:

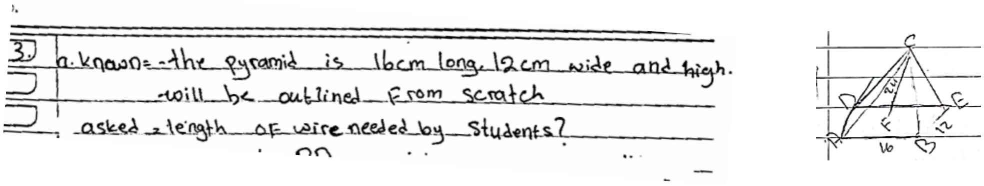

Figure 15. SR answer point A

The mathematical problem-solving skills in Figure 15 can be analyzed as indicators of building new mathematical knowledge through solving. This indicator allows the subject to understand and utilize information from the problem to create a picture illustration. This indicator can be confirmed and explained through the following interview results:

P : "What do you understand from the question?"
SR : "The pyramid is 16 cm long, 12 cm wide, and 24 cm high. A wireframe will be made. So, the length of wire needed by students is."
P : "How do you present the problem to the drawing form?"
SR : "After I read the problem, I drew the pyramid with the length."

The interview results showed that the SR subject could state the information from the problem, and the SR subject rewrote the important information according to the sentence in the problem. The subject can utilize information to illustrate the problem in a pyramid drawing and its size appropriately.

The results of the SR answer at point B are as follows:

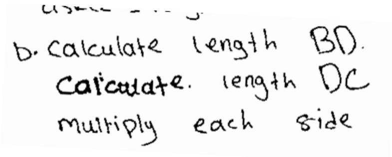

Figure 16. SR answer point B

Figure 16 Mathematical problem-solving skills are analyzed using indicators of solving problems in mathematics or other contexts. Based on the answer results, the subject can determine alternative strategies to solve problems that are not yet effective. This indicator can be confirmed and explained through the following interview results:

R : "Describe the strategy you will use."
SR : "Calculate the length of BD, DC. When you find the lengths, then multiply the sides."
R : "Is the problem related to other materials?"
SR :" Yes, mom, but I do not know what material to use because I forgot, mom. If I am not mistaken, it is power and roots."
R : "Are you sure your answer is right?"
SR : "I do not know mom"

Based on the interview results, the SR subject could explain the strategy to be used well even though there was an error in the last strategy, which should have been summed instead of multiplied. SR subject was able to link the solution strategy used. SR's subject determined the problem-solving strategy even though it was not optimal.

The results of the SR answer at point C are as follows.

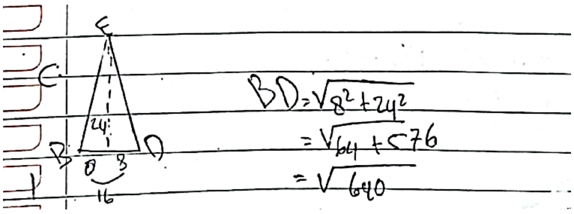

Figure 11. SR answer point C

Figure 11 shows that the indicator of mathematical problem-solving skills analyzed is applying various appropriate problem-solving strategies. Subject SR has been unable to solve the problem according to his plan. So, if the SR subject is not able to get the right results, this indicator can be confirmed and explained through the following interview results:

R : "Are you sure that your solution process is correct?"
SR : "No, mom."
R : "Why don't you continue?"
SR :" I am a confused mom. Which side should you use to find DC?"
R : "Want to research again while reading the notebook?"
SR : "No, Mom, hehe"

Based on the interview results, SR subjects did not adequately understand mathematical concepts to carry out their plans. The subject gives up more quickly when facing problems related to everyday problems, so the solution results are less precise. The subject's motivation to solve problems is also relatively low.

SR subject has been unable to monitor and reflect on the mathematical problem-solving process. Seen from the answer, the subject could not write the conclusion of the results obtained. The subject also lacked monitoring of the problem-solving process, as seen from the number of incorrect subject answers. This indicator can be confirmed and explained through the following interview results:

R : "Did you recheck your answer?"
SR : "No mom."
R : "Why?"
SR : "It is okay, mom, I am already dizzy. So I immediately collected it."
R : "So, are you sure your answer is correct?"
SR : "No mom"
R : "Need to check again? If there is an error, can you correct it?"
SR : "I cannot, Mom."

The interview results showed that the SR subject did not realize the importance of re-examining the answers obtained. SR subjects tend to give up easily and do not want to try when they find complex problems. In this indicator of re-examining the answer, the SR subject did not try to solve the problem because he had lost motivation.

The results of this study show that students with low self-efficacy show less competence in mathematical problem-solving. This study's findings show low self-efficacy students often feel pressured by math problems and do not have strong commitment and interest in completing tasks. Students easily give up and do not have extensive knowledge about the concept of the Pythagorean theorem and the surface area of a space, making it difficult to solve problems.

The findings in this study align with the results of research by Mudzakin et al. (2022) that students with low self-efficacy often have difficulty finding solutions to problems. This is shown in the problem-solving indicators, namely applying various appropriate strategies to solve problems and monitoring and reflecting on the problem-solving process, which requires students to solve mathematical puzzles but fail to do so. Students' unwillingness to try harder and the tendency to give up easily on complex tasks are indicators of their low self-efficacy (Fatmasari et al., 2021). Ozkal (2019) stated that low self-efficacy students have more time to be lazy and are not motivated to make good use of time.

Table 3. Student Achievement Based on Self-Efficacy

High Self Efficacy	Medium Self Efficacy	Low Self Efficacy
Able to fulfill four indicators of problem-solving skills optimally	Only not optimal on indicators of applying various appropriate strategies to solve problems	Only optimal indicators of building new knowledge through problem-solving and solving problems in mathematics or other contexts
I have a strong commitment, never give up, can use my knowledge well, and can develop different problem-solving strategies that other students do not think of.	A strong enough commitment to solving problems leads to a lack of confidence in their abilities—a lack of a good understanding of math concepts results in planning.	Students often feel pressured by math problems, do not have a strong commitment and interest in completing tasks, and do not have extensive knowledge of the mathematical concepts used.

The results of the analysis and discussion of this study indicate that self-efficacy is one of the important aspects and should be owned by students. This is because students with high self-efficacy tend to have high mathematical problem-solving skills. Conversely, students with low self-efficacy tend to have low mathematical problem-solving skills. Based on existing theory, the results of previous research conducted by Sa'diyah et al. (2024), Imaroh et al. (2021), Damianti & Afriansyah (2022), and the results of this study have a match. The results showed that students' problem-solving success aligned with their self-efficacy.

CONCLUSION

Based on the results and discussion of the research, the following conclusions can be drawn: The project-based learning model assisted by GeoGebra is effective in mathematical problem-solving ability, subjects with high self-efficacy can fulfill all indicators of mathematical problem-solving ability, moderate self-efficacy subjects are only not optimal in the indicator of applying various appropriate strategies to solve problems, while low self-efficacy subjects are only optimal in indicators of building new mathematical knowledge through problem-solving and solving problems in mathematics or other contexts.

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