ISSN 2964-4291
https://proceeding.unnes.ac.id/index.php/iset

Mathematical Problem-Solving Ability from Self-Regulated Learning for Class 10th Senior High School Students

Nurina Hidayah[1,2,*], Windi Dina Safitri[2], Zaenuri Zaenuri[1], Iwan Junaedi[1], Masrukhan Masrukhan[1]

[1]Universitas Negeri Semarang, Indonesia

[2]Universitas Pekalongan, Indonesia
*Corresponding Author: nurihidayah.matematika@gmail.com

Abstract. There is a relationship between mathematical problem-solving ability and student self-regulated learning. Data collection using trigonometric comparison math problems and self-regulated learning questionnaires. The subjects in this study were students of class 10th at senior high school 1 Doro. They were taking research subjects based on the category of student self-regulated learning consisting of low, medium, and high levels. Data analysis techniques in this study are data reduction, data presentation, and conclusion drawing. Four indicators of problem-solving ability are used, including understanding the problem, designing problem-solving strategies, performing calculations, and looking back at the problem-solving results. The results indicate that students with a high level of self-regulated learning have problem-solving abilities that tend to be better. Students with high self-regulated learning can meet the indicators of problem-solving ability at the stage of understanding the problem. They are less able at stages to design problem-solving strategies and perform calculations. The finding is that the subject cannot meet the step of looking back on problem-solving. Second, students with moderate self-regulated learning have problem-solving abilities that tend to be quite good. Students in moderate self-regulated learning have not been fully able to meet the indicators of problem-solving ability in understanding the problem. They are unable to complete the other problem-solving stages. Third, students with low levels of self-regulated learning have problem-solving abilities that tend to be less good. Students in this category cannot meet the four indicators of problem-solving ability.

Key words: mathematics; problem-solving ability; self-regulated learning

How to Cite: Hidayah, N., Safittri, W.D., Zaenuri, Z., Junaedi, I., Masrukan, M. (2022). Mathematical Problem-Solving Ability from Self-Regulated Learning for Class 10th Senior High School Students. *ISET: International Conference on Science, Education and Technology* (2022), 456-467.

INTRODUCTION

Mathematics is one component in the field of science that has an essential role in various aspects of life. Learning mathematics can form critical thinking patterns in solving problems in everyday life. Mathematics is a science that studies calculations and uses one's reasoning or thinking ability logically and with a clear mind (Sapitri *et al*., 2019). However, until now, many students still feel that mathematics is complex and not fun, especially in the era of the covid-19 pandemic. The COVID-19 pandemic has brought many changes, especially in teaching and learning activities in the classroom. Classes that were originally face-to-face to virtual courses. It certainly has an impact on student behavior in learning. In learning mathematics, for example, students will tend to have difficulty capturing abstract material concepts that require intense assistance from the teacher. Abstract mathematical concepts cause students to have trouble applying mathematical problem-solving skills.

Mathematical problem-solving ability is a fundamental aspect of learning mathematics, as contained in the Content Standards for Primary and Secondary Education Permendikbud Number 21 of 2016. The content standard states that students are expected to be able to apply knowledge in specific fields of study according to their talents and interests to solve problems (Permendikbud, 2016). In line with that, NCTM states that the standard of mathematical ability students must have the ability to solve mathematical problems, reason and prove, communication skills, connection skills, and represent skills. Mathematical problem-solving is finding ways to solve a problem by observing, understanding, guessing, and finding and reviewing the solution to a problem (NCTM, 2000). According to Hendriana in Sriwahyuni (2019), the mathematical problem-solving ability is a factor that must be considered in learning mathematics, primarily to obtain meaningful mathematical knowledge. From the description, it can be seen that mathematical problem-solving

ability is an essential component in learning mathematics.

Based on its role and importance, mathematical problem-solving ability is one of the student's abilities that needs to be studied in depth. Based on the observations made by researchers during the internship (PLP 2) program at SMA N 1 Doro, information was obtained that learning had been done quite well. However, when the researchers observed students solving math problems, the researchers found several tendencies. These tendencies include; 1) Some students can solve math problems but cannot provide proofs and reasons for some solutions; 2) Some students are less able to determine the pattern or nature of mathematical phenomena; 3) Some students have difficulty in providing explanations and interpretations of what they have learned. Based on the results of interviews conducted with mathematics teachers confirming the three tendencies in students. The teacher also said that students tend to rely on examples of problem-solving given by the teacher. So when given a new problem, students can not solve it. Focus on examples of solutions the teacher gives, making students' mindsets narrow and undeveloped. Students in the medium category in mathematical problem-solving abilities experience forgetting in assuming problems which result in less confidence in solving problems (Hidayah and Nabila, 2022). In addition, there are still difficulties in solving problems which include making mathematical connections, such as in different representations, part-whole relationships, connections between mathematical concepts, and interrelationships between mathematical procedures (Jailani *et al.*, 2020).

Self-regulated learning is an essential aspect of solving mathematical problems, especially learning during this pandemic. Students inevitably have to adapt to circumstances that require them to behave independently. Self-regulated learning is an effort to carry out learning activities independently based on the motivation to master a specific material so that it can be used to solve the problems at hand (Asmar & Delyana, 2020). Through self-regulated learning, students can construct mathematics learning to be meaningful. There is a positive relationship between self-regulated learning and mathematical problem-solving ability (Sulistyani, Roza, & Maimunah, 2020).

Furthermore, Asworowati (2020) also argues that the higher the student's independence, the higher the student's mathematics learning outcomes. And vice versa, the lower the student's independence, the lower the student's mathematics learning outcomes. Self-regulated learning affects 17% of students' mathematical problem-solving abilities (Mayasari & Rosyana, 2019). Students are said to be autonomous learning if there is a development of the ability of students to carry out the process without relying on teachers, classmates, and others.

This study aims to reveal how students' mathematical problem-solving abilities are viewed from self-regulated learning. The results of this study are expected to optimize mathematics learning through new learning innovations so that teaching and learning activities can be carried out better and achieve the criteria for completeness of problem-solving abilities.

METHODS

The type of research used in this study is qualitative research with a descriptive approach. The descriptive approach discusses mathematical problem-solving abilities regarding students' self-regulated learning. The results of this study are in the form of written words regarding the achievement of indicators of mathematical problem-solving abilities in student self-regulated learning. The research subjects used were students of class X SMA N 1 Doro. Determination of the subject of each category of self-regulated learning is based on the results of discussions between researchers and mathematics teachers and considers the effectiveness of students' answers.

The research procedures used are (1) the pre-research stage, which consists of determining the research focus, taking care of licensing, and observation. (2) the initial stage consists of designing research instruments, validating, conducting trials, and analyzing test results with the value of reliability, discriminatory power, and difficulty level. (3) Core stage consists of conducting research, analyzing self-regulated learning questionnaires, analyzing test scores, selecting subjects in each category of self-regulated learning, conducting interviews, and conducting triangulation (4) reporting stage, namely the stage of writing research results systematically by researchers.

The analysis technique used in this research is data reduction, data presentation, and conclusion drawing. The instruments used in this study were problem-solving ability test instruments, non-test

instruments for self-regulated learning, and interviews. The test instrument consists of 3 description questions, while the self-regulated learning questionnaire consists of 20 positive and negative statements. The topic in the problem-solving ability test is trigonometric comparisons. The indicators of problem-solving ability used are (1) understanding the problem, (2) designing problem-solving strategies, (3) performing calculations, and (4) re-examining the results of problem-solving (Polya G, 1988). While the indicators of self-regulated learning used in this study are (1) intrinsic learning initiative and motivation, (2) diagnosing learning needs habits, (3) setting learning goals/targets, (4) monitoring, regulating, and controlling learning, (5) Seeing difficulties as a challenge, (6) Utilizing and seeking relevant sources, (7) Selecting, implementing learning strategies, (8) Evaluating learning processes and outcomes, (9) Self-concept/self-ability (Arofah & Noordyana, 2021).

Before the test instruments and questionnaires were used, the instruments were validated by two validators. The results of the feasibility test of the test instrument showed that it was feasible to use with a validity value of 0.617, a reliability value of 0.6786, a difficulty index in the medium to the difficult category, and good to excellent discriminating power. In addition, the non-test instrument feasibility test results are also suitable for use, with a validity value of 0.741 and a reliability value of 0.6822. Therefore, the instrument can collect data on students' mathematical problem-solving ability tests and self-regulated learning questionnaire data.

Data on self-regulated learning was obtained from filling out a questionnaire by students of class X MIPA 1 on May 20, 2022. The results of the questionnaire were analyzed according to the assessment guidelines and grouped based on the level of autonomous learning. The formulas used in grouping categories are presented in Table 1.

Table 1. Grouping of Self-Regulated Learning Data

Group	Score
High	$X \geq \bar{X} + 1.SD$
Moderate	$\bar{X} - 1.SD \leq X < \bar{X} + 1.SD$
Low	$X < \bar{X} - 1.SD$

Note :
$X = score\ from\ questionnaire\ data$
$\bar{X} = mean$
$SD = standard\ deviation$

RESULTS AND DISCUSSION

RESULTS

After doing a mathematical problem-solving test and distributing questionnaires in class X MIPA 1 SMA N 1 Doro to 32 students, self-regulated learning was obtained by as many as six students in the high category, 20 in the medium category, and six students in the low category. The percentages in each category are presented in Figure 1.

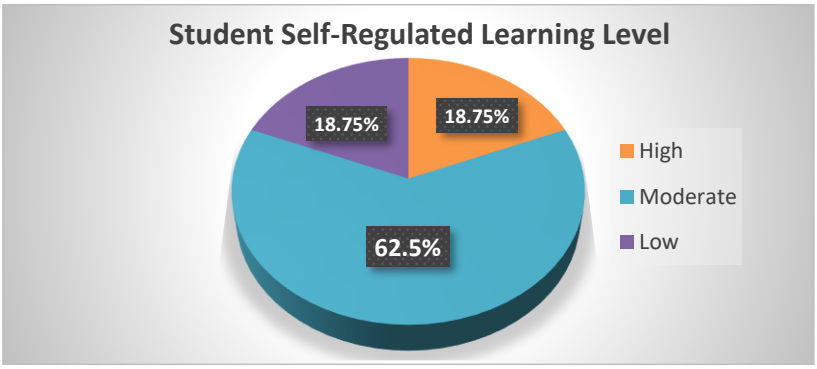


Figure 1. Percentage of Self-Regulated Learning Category

Figure 1 talks about self-regulated learning; the results show that as many as 18.75% of students fall into the category of high, 62.5% of students fall into the category of moderate, and 18.75% fall into the category of low. Then scoring was done on the problem-solving ability

test, and interview subjects were taken among four students representing each category of self-regulated learning. The four subjects used in this study are shown in Table 2.

Table 2. List of Research Subjects

No	Subject Code	Grouping of Self-Regulated Learning	Mathematical problem solving scores
1.	R1-AA-2	High	15
2.	R27-RK-2	Moderate	7
3.	R8-DA-2	Moderate	6
4.	R11-FR-1	Low	2

Analysis of Mathematical Problem Solving Ability Viewed from a High Level of self-regulated learning.

Based on the results of the self-regulated learning questionnaire from 32 students, 18.75% of students in the high independence category or equivalent to 6 students in the high independence category. From the six students, one subject was taken, the respondent R1-AA-2, with a score of 15.

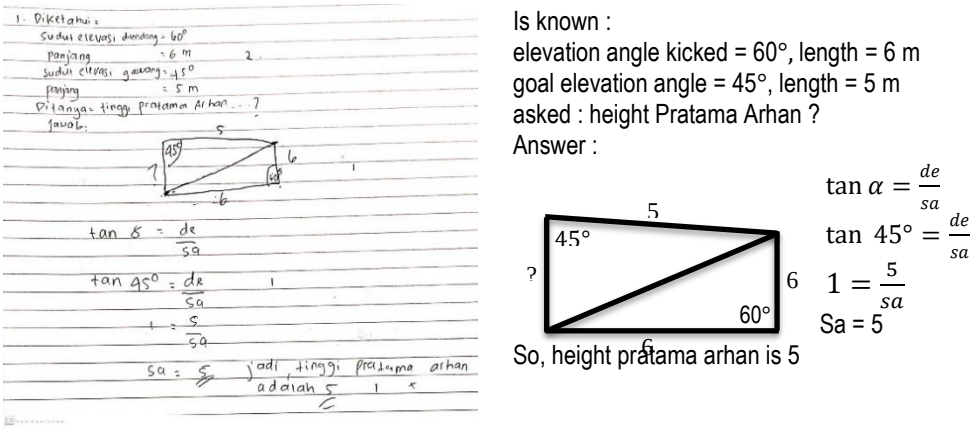
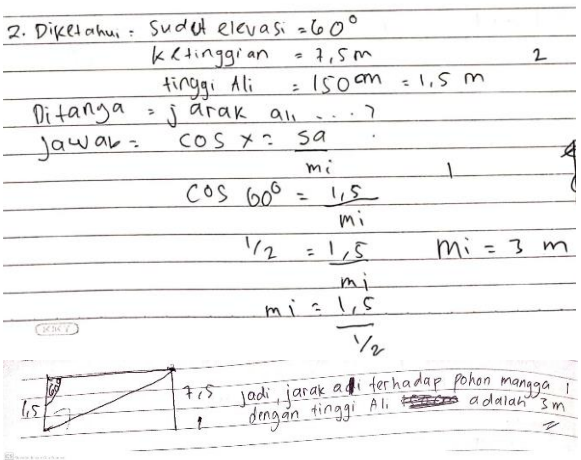
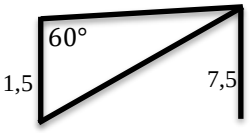


Figure 2. answer number 1 subject R1-AA-2

In Figure 2, respondents R1-AA-2 were able to complete the questions in a structured way, but not yet thoroughly; the answers obtained were correct. Respondents have not entirely fulfilled all indicators perfectly. In (1) understanding the problem, respondents R1-AA-2 were able to write down the known elements and asked in full. Step (2) makes a settlement plan, respondent R1-AA-2 puts the elements in the mathematical drawing/scheme, but there are still schema errors and misinterprets of the values. The error incorrectly determined the trigonometric ratio, which should be a sine ratio; the respondent used a tangent ratio. In step (3), the calculation has been carried out coherently, but the results obtained are inappropriate due to an error in the second step. Step (4) looking back: After finding the answer, the respondent has written a conclusion but did not check with another formula, so the results obtained are less precise, and they do not know that the answer is wrong.



Is Known :
elevation angle = 60°, height= 7.5 m
Ali Height = 150 cm = 1.5 m
asked : distance Ali ?
Answer :

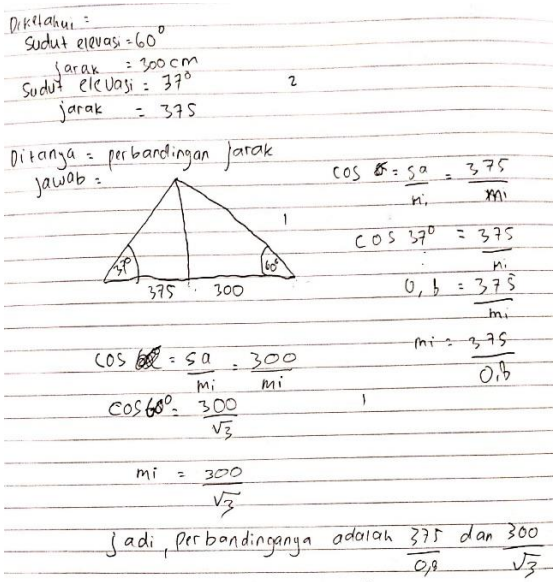


$\cos \alpha = \frac{sa}{mi}$
$\cos\ 60° = \frac{1.5}{mi}$
$\frac{1}{2} = \frac{1.5}{mi}$
$mi = \frac{1.5}{\frac{1}{2}} = 3$

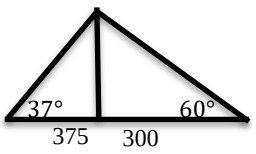
So, Ali's distance from the mango tree with Ali's height is 3 meters.

Figure 3. answer number 2 subject R1-AA-2

In Figure 3, respondents R1-AA-2 were able to solve the questions until the end in a structured manner, but the answers were also incorrect. Respondents have not fully met all indicators of mathematical problem-solving. Step (1) is understanding the problem; the respondent ultimately writes down the known elements and questions. Step (2) makes a settlement plan; respondent R1-AA-2 describes mathematical patterns/illustrations but is still unably interpreting the value and planning it so that the use of trigonometric comparisons is not appropriate. It should be a tangent ratio; respondents use a cosine ratio. Step (3) calculation, the respondent has coherently done the calculation. Errors in determining the strategy resulted in incorrect calculation results Errors also occur in determining the side and hypotenuse. Step (4) re-checking, the respondent wrote the conclusion, but it was still wrong and did not check with another formula so that they did not know that the answer was wrong.



Is known :
elevation angle = 60°, distance = 300 cm
goal elevation angle = 37°, length = 375 cm
asked : distance comparison?
answer :



$\cos \alpha = \frac{sa}{mi}$
$\cos\ 37° = \frac{375}{mi}$
$0{,}8 = \frac{375}{mi}$
$mi = \frac{375}{0.8}$

$\cos \alpha = \frac{sa}{mi} = \frac{300}{mi}$
$\cos\ 60° = \frac{300}{\sqrt{3}}$
$mi = \frac{300}{\sqrt{3}}$

so, the comparison is $\frac{375}{0,8}$ and $\frac{300}{\sqrt{3}}$

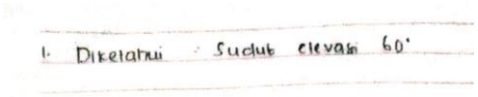
Figure 4. answer number 3 subject R1-AA-2

In Figure 4, respondents R1-AA-2 can solve mathematical problems up to stage four in a structured manner. Although it has fulfilled the four problem-solving steps, the final answer is inappropriate. Step (1) to understand the problem, the respondent writes down the known elements and mentions the elements being asked in full. Step (2) makes a settlement plan; respondents R1-AA-2 write down the elements in a mathematical pattern with the suitable scheme. However, in interpreting the value, one element is misperception, interpreting the distance of view as the distance between objects. In addition, the determination of the trigonometric ratio used is correct, namely using cosine. In step (3) calculation, the respondent mentioned that the

cosine of the angle is equal to the side divided by the hypotenuse. However, because at the planning stage, there was an error, the calculation was reversed and resulted in an inaccurate answer. Step (4) looking back at this stage, the respondent concludes that the results are still wrong.

Analysis of Mathematical Problem Solving Ability Viewed from Moderate Level of Self-Regulated Learning

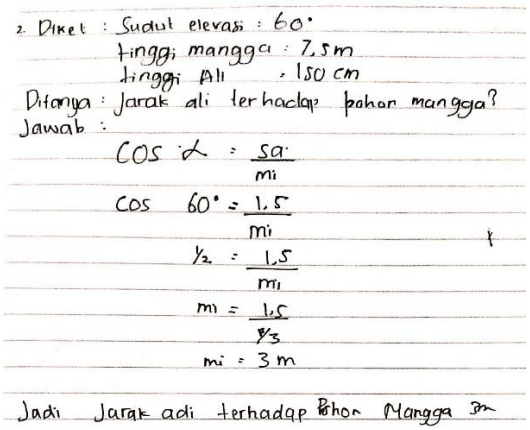
There are 62.5% of students in the category of moderate independence or equivalent to 20 students in the category of moderate independence. Furthermore, 2 subjects were taken, namely respondents R27-RK-2 and respondents R8-DA-2.



1. Is known : elevation angle 60°

Figure 5. answer number 1 R27-RK-2

In figure 5, respondents R27-RK-2 could not solve the questions until the end including (1) understanding the problem, at this stage respondents R27-RK-2 only wrote down one known element and did not write down other elements or elements being asked. (2) making a settlement plan, at this stage the respondents R27-RK-2 did not include any mathematical schemes/patterns and did not carry out any plans. (3) perform calculations; the respondent does not write down any calculation process at this stage. (4) rechecking, respondents R27-RK-2 did not draw any conclusions at this stage.



Is known :
Angle elevation = 60°, mango height = 7.5 m
Ali height = 150 cm
asked : Ali's distance from the mango tree?
answer :

$\cos \alpha = \frac{sa}{mi}$

$\cos\ 60° = \frac{1.5}{mi}$

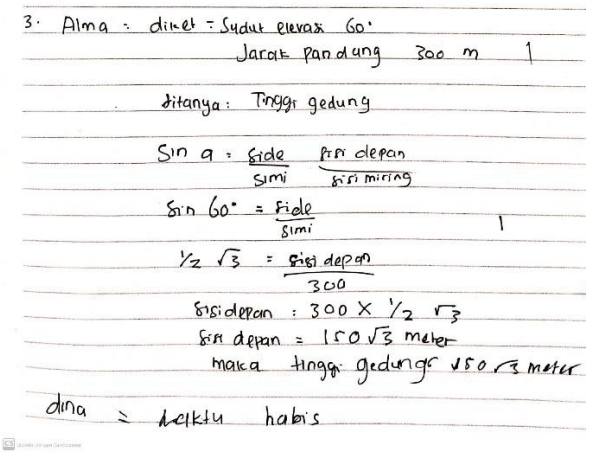
$\frac{1}{2} = \frac{1.5}{mi}$

$mi = \frac{1.5}{\frac{1}{2}} =\ 3$ m

So, the distance from Ali to the mango tree is 3 m .

Figure 6. answer number 2 R27-RK-2

In Figure 6, respondents R27-RK-2 can complete the questions until the end in a coherent but incomplete manner, including (1) understanding the problem; at this stage the respondent can write down the elements that are known in full and write down what is being asked of the problem. (2) make a plan, at this stage the respondent R27-RK-2 does not describe the mathematical scheme/pattern but makes a solution plan using the cosine comparison even though the tangent ratio is actually correct. (3) performs calculations, at this stage the respondent R27-RK-2 basically it is coherent but there are errors in determining the initial strategy and errors in determining the sides and sloping sides. (4) re-checking, at this stage respondents R27-RK-2 can draw conclusions but the results obtained are still not correct and do not check with other formulas so they do not know that the answer is wrong.



Alma is known :
Elevation angle 60°
viewing distance 300m
asked : building height ?

$$\sin \alpha = \frac{side}{simi} = \frac{opposite\ side}{hypotenuse}$$

$$\sin 60° = \frac{side}{simi}$$

$$\frac{1}{2}\sqrt{3} = \frac{opposite\ side}{300}$$

Opposite side = 300 x $\frac{1}{2}\sqrt{3}$

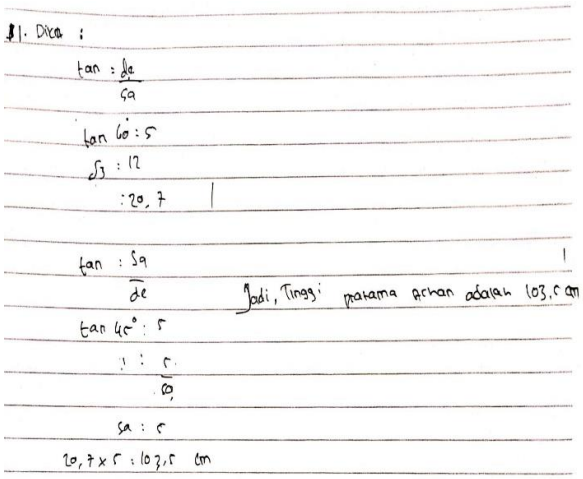
Opposite side = 150 $\sqrt{3}$ meter

Then the height of the building 150 $\sqrt{3}$ meter

Dina = time has run out

Figure 7. Answer number 3 R27-RK-2

In figure 7, respondents R27-RK-2 can only complete half of the parts including (1) understanding the problem, at this stage the respondent writes down the elements that are known but not yet complete and mentions the elements being asked but misperceptions where the distance ratio should be but instead is high building. (2) make a plan, at this stage the respondent does not describe a mathematical scheme/pattern but makes a solution plan by using a sine comparison instead of using cosine. (3) perform calculations, at this stage basically the respondent has carried out calculations coherently, but because it was wrong at the beginning related to what was asked in the question the results obtained were not accurate. (4) rechecking, at this stage the respondent could not give any conclusions because it some steps have not been completed because the time is up.



Is known :

$$tan = \frac{de}{sa}$$

$$\tan 60° = 5$$

$$\sqrt{3} = 12$$

$$= 20.7$$

$$tan = \frac{sa}{de}$$

$$\tan 45° = 5$$

$$1 = \frac{5}{sa}$$

Sa = 5

20.7 x 5 = 103.5 cm

So the height of the primary arhan is 103.5 cm.

Figure 8. Answer number 1 R8-DA-2

In figure 8, the subject of R8-DA-2 solves the problem in a coherent manner to the end but it is still not quite right, including (1) understanding the problem, at this stage the respondent R8-DA-2 does not mention the elements that are known and asked. (2) make a settlement plan, at this stage, the subject does not include elements in the mathematical scheme/pattern but immediately provides a solution strategy even though it is still not quite right, which should use a sine comparison but uses a tangent comparison. (3) doing calculations, at this stage in doing calculations the subject still has the wrong concept where dividing the angle of 60° by a value of 5 which should be the distance of view. (4) re-checking, at this stage the subject of R8-DA-2 draws a conclusion that the results obtained are still not correct.

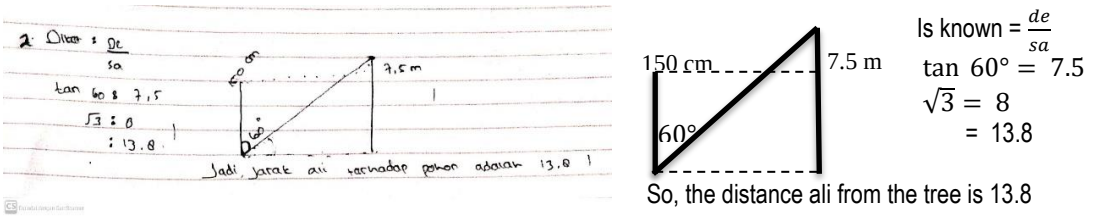


Figure 9. Answer number 2 R8-DA-2

In figure 9, the subject of R8-DA-2 worked until the end but it was not coherent and still not correct including (1) understanding the problem, at this stage the respondent did not write down the elements that were known and asked (2) make a settlement plan, at this stage elements are interpreted in mathematical schemes/patterns but are still wrong in interpreting the viewing distance and angle which should be from the corner of the eye but depicts it from the feet. However, the planning of trigonometric comparisons is correct, namely using tangent ratios. (3) carry out calculations, at this stage the subject is still unable to because there is an error in substituting the front side value and even misoperating the concept of calculating the right and left sides so that the results obtained are not correct. (4) re-checking, at this stage the respondent draws a conclusion but the results obtained are still not correct.

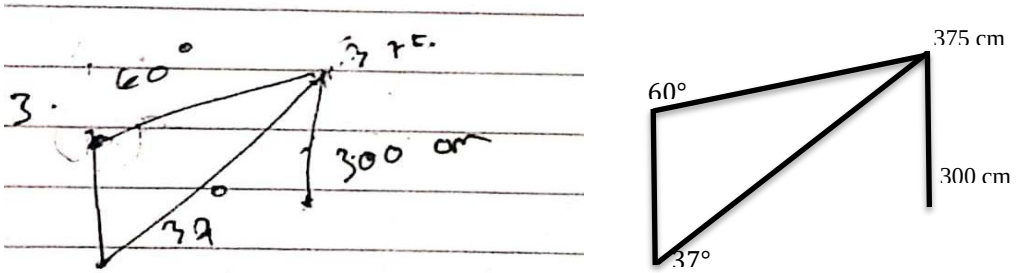
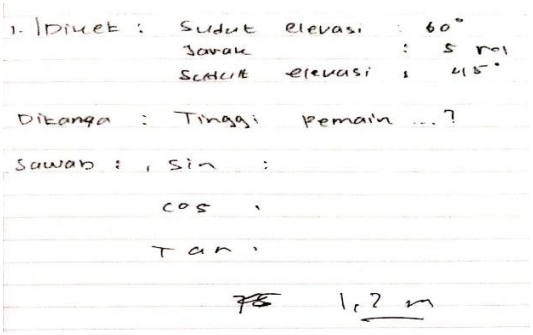


Figure 10. Answer number 3 R8-DA-2

In figure 10, the subject of R8-DA-2 has not been able to work until the final stages, including (1) understanding the problem, this stage the respondent does not write down the elements that are known and asked (2) make a settlement plan, this stage the respondent pours out the elements in the scheme/ the mathematical pattern but the interpretation of the values is not clear besides that there is an error in making the scheme where the Alma case should be on the right of the building and the Dina case on the left but instead are combined into one so that it is confusing to plan the trigonometric comparisons used. (3) perform calculations, at this stage the respondent does not perform any calculations because there is no trigonometric comparison plan used. (4) re-checking, the respondent cannot draw any conclusions at this stage.

Analysis of Mathematical Problem Solving Ability Viewed from Low Level of self-regulated learning

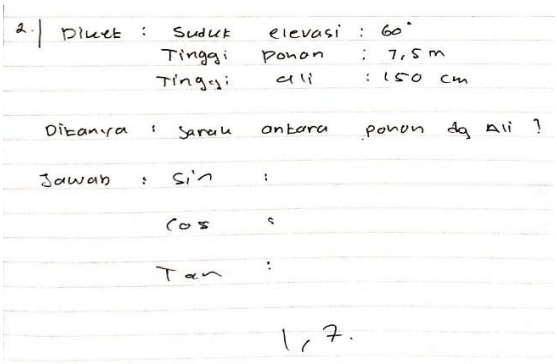
Based on the results of the self-regulated learning questionnaire from 32 students, there were 18.75% of students in the low independence category or equivalent to 6 students in the low independence category. From the 6 students, 1 subject was taken, namely the respondent R11-FR-1 with a score of 2.



Is known : angle elevation = 60°
distance = 5 m
angle elevation = 45°
Ditanya : player height ...?
Jawab : sin :
cos :
tan :
1.7 m

Figure 11. Answer number 1 R11-FR-1

In figure 11, respondent R11-FR-1 could not solve the problem until the end including (1) understanding the problem; at this stage the respondent mentioned the elements that were known but not complete and stated what was asked. (2) make a settlement plan, at this stage there is no written plan. (3) perform calculations, at this stage the respondent does not perform any calculations and (4) checks again, the respondent is unable to draw any conclusions, only writes down the final results without processing.

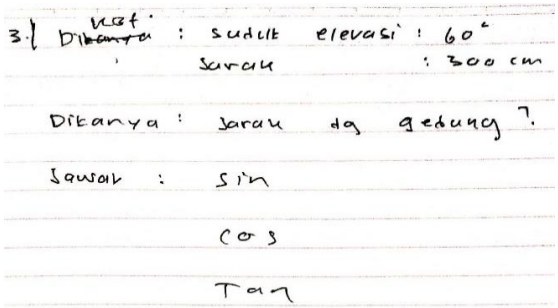


Is known : angle elevationi = 60°
Tree height = 7.5 m
Ali height = 150 cm
asked : distance between tree and Ali

Jawab : sin :
cos :
tan :
1.7 m

Figure 12. Answer number 2 R11-FR-1

In figure 12, respondent R11-FR-1 could not solve the problem until the end including (1) understanding the problem, at this stage the respondent mentioned the known elements and mentioned what was asked. (2) make a settlement plan, at this stage there is no written plan. (3) perform calculations, at this stage the respondent does not perform any calculations and (4) checks again, the respondent is unable to draw any conclusions, only writes down the final results without processing.



Is known : angle elevation = 60°
distance = 7.5 m
asked : distance to building ?

Jawab : sin :
cos :
tan :

Figure 13. Answer number 3 R11-FR-1

In Figure 13, respondent R11-FR-1 could not solve the problem until the end including (1) understanding the problem, at this stage the respondent mentioned elements that were known but not complete and did not mention what was asked. (2) make a settlement plan, at this stage there is no written plan. (3) perform calculations, at this stage the respondent does not perform any calculations and (4) checks again, the respondent is unable to draw any conclusions.

DISCUSSION

In this section, the researcher describes the results of the research in the previous section, namely the ability to solve mathematical problems in terms of self-regulated learning. The items used in this study are presented in table 3.

Number of question	Question
1.	A footballer, Pratama Arhan is practicing targeting. Arhan stands in front of the goal with a certain distance. If the ball is kicked with an elevation angle of 60 ° towards the top of the goal, the distance from Arhan's feet to the top of the goal is 6 meters. Meanwhile, if the ball is headed towards the top of the goal with an elevation angle of 45°, the distance of the header from Arhan's head to the top is 5 meters. Determine the height of Primary Arhan ! (Assuming Arhan's distance from the post is the same when heading and kicking)
2.	Ali observes the mango fruit right on the tree at an elevation angle of 60° and intends to shoot it using a slingshot. If the mango is at an altitude of 7.5 m above ground level. Then determine the distance Ali from the mango tree with Ali's height 150 cm!
3.	On the right side of the building, you can see Alma standing observing the top of the building with an elevation angle of 60° and Alma's visibility to the building is 300 cm. On the other hand, on the left side of the building, Dina observes the top of the same building with an elevation angle of 37° and Dina's view distance to the top of the building is 375 cm. find the ratio of Alma's distance and Dina's distance from the building! (Hint: Sin 37° = 0.6 , Cos 37° = 0.8 and Tan 37° = 0.75).

Discussion of the results of research on mathematical problem solving abilities in terms of learning independence in each category is presented in the following description.

Mathematical Problem Solving Ability Viewed from a High Level of Independent Learning

In this study, subjects R1-AA-2 had better problem-solving abilities than other subjects, based on the results of a self-regulated learning questionnaire, this subject occupied a high level of self-regulated learning so that they were able to work on all three questions in a coherent manner until they found an answer even though this subject did not fully meet all of the requirements indicator of problem-solving ability. This is in accordance with the results of Hermaitriyana & Samsir (2021) research which states that students with good self-confidence also have good problem-solving abilities.

Based on the results of triangulation of answers to the three questions and interview subjects R1-AA-2 was able to understand the problem at the stage, less able to do planning and do calculations. This is indicated by the fact that there are still misperceptions in describing patterns and interpreting one of its elements. Then unable to in the fourth stage, which is to check correctly.

After an interview session was held outside of questions about clarifying the answers to questions, the subject explained that he really liked mathematics but in this case the subject admitted that he was not used to being faced with problems with high-level thinking concepts, the subject also said he had worked on category questions like this on the internet, therefore it is not surprising if you are able to complete all three questions to the end even though you still haven't produced the right answer.

Mathematical Problem Solving Ability Viewed from Medium Level of Self-Regulated Learning

In this study, subjects R27-RK-2 and subjects R8-DA-2 had fairly good problem-solving abilities. based on the results of the self-regulated learning questionnaire, this subject has a level of self-regulated learning in the medium category. These results are in accordance with research conducted by Ekananda, Pujiastuti & Anwar (2020) which states that students with moderate levels of self-regulated learning tend to have moderate mathematical problem-solving abilities. Of the three questions given, only two can be solved coherently until the final stage, for the other questions only complete part of the whole process.

Based on the results of triangulation of answers to the three questions and interviews, subjects R27-RK-2 and subjects R8-DA-2 were still not fully capable at the stage of understanding the problem. This is indicated by the fact that there is one element left that is not included and there is still an error in mentioning what was asked. The two subjects also have not

been able to plan, calculate and re-check. This is indicated by the absence of a planning process at all, there are still miscalculations and do not give any conclusions.

After the interview session was carried out outside of questions about answers. Subject R27-RK-2 explained that he was not very interested in mathematics, the subject was rarely faced with cases like this so it was foreign the subject is more interested in working on math problems that are not presented in story problems. On the other hand, the subject of R8-DA-2 explained that he also rarely worked on questions in the form of story questions so that it was difficult to do them. Therefore, it is natural that subjects R27-RK-2 and subject R8-DA-2 still have not completely completed the three questions in a coherent manner until the final stage.

Mathematical Problem Solving Ability Viewed from Low Self-Regulated Learning Level

In this study, the subject of R11-FR-1 had poor problem-solving abilities compared to other subjects. Based on the self-regulated learning questionnare, this subject is included in the low level of self-regulated learning. This is in line with research conducted by Rodliyah, Abidin & Syaifuddin (2018) which explains that subjects with low levels of self-regulated learning have poor mathematical problem-solving abilities. Of the three questions given, none of the R11-FR-1 Subjects could solve them until the final stage of finding the answer. Based on the results of triangulation tests and interviews, the subject of R11-FR-1 was unable to fulfill the four stages of problem-solving abilities. This is indicated by the absence of a clear solution, even the subject feels confused about understanding the problem.

After conducting an interview session outside of questions about answers. Subject R11-FR-1 explained that he did not like teaching mathematics and the subject tried to solve mathematical problems but couldn't.

CONCLUSION

Based on the results of the analysis and discussion that have been described in the previous chapter, the conclusions of the study are obtained, namely, (1) students with a high level of independence have problem-solving abilities that tend to be better. Students in this category are able to meet the indicators of problem-solving ability at stage 1, less able at stages 2 and 3 and unable to meet stage 4. (2) students with a moderate level of independence have problem-solving abilities that tend to be quite good. Students in this category have not been fully able to meet the indicators of problem-solving ability stage 1 and are not able to meet stages 2,3 and stage 4. (3) students with low levels of independence have problem-solving abilities that tend to be less good. Students in this category are not able to meet the four indicators of problem-solving ability.

From the final conclusions that have been written, the researchers hope that in the future this research can be used as a reference to increase self-regulated learning so that problem-solving abilities increase according to the context of real life. In addition, researchers also hope that this research can be studied further on the independence of students in learning mathematics to find appropriate strategies to improve their mathematical problem-solving abilities.

REFERENCES

Arofah, M. N., & Noordyana, M. A. (2021). " Mathematical Problem Solving Ability Judging from the Independent Learning of Students on Circle Materials in Muarasanding Village [Kemampuan Pemecahan Masalah Matematis Ditinjau dari Kemandirian Belajar Siswa pada Materi Lingkaran di Kelurahan Muarasanding]". Plusminus : Jurnal Pendidikan Matematika, 1, 421 - 434.

Asmar, A., & Delyana, H. (2020). "The Relationship between Independent Learning and Critical Thinking Skills Through the Use of Geogebra Software [Hubungan Kemandirian Belajar Terhadap Kemampuan Berpikir Kritis Melalui Penggunaan Software Geogebra]". AKSIOMA : Jurnal Program Studi Pendidikan Matematika, 9, 221–230.

Asworowati, M. T. (2020). "The Relationship of Independent Learning with Mathematics Learning Outcomes of Class V Elementary School Students in Grabag District for the 2019/2020 Academic Year [Hubungan Kemandirian Belajar dengan Hasil Belajar Matematika Siswa Kelas V SDN Se-Kecamatan Grabag Tahun Ajaran 2019/2020]". Kalam Cendekia: Jurnal Ilmiah Kependidikan, 8, 77–82.

Ekananda, A., Pujiastuti, H., & Anwar, C. (2020). "Analysis of Mathematical Problem-Solving Ability Viewed from Students' Independent Learning [Analisis Kemampuan Pemecahan Masalah Matematis Ditinjau Dari

Kemandirian Belajar Siswa]". Jurnal Inovasi dan Riset Pendidikan Matematika, 1, 367 – 382.

Hermaitriyana, & Samsir. (2021). "Students' Mathematical Problem-Solving Ability Reviewed from the Self-Confidence of Junior High School Students". Journal of Research on Mathematics Instruction, 2 , 15 - 27.

Hidayah, N. and Nabila, N. (2022) 'Analysis of Metacognical Ability Review of Students' Mathematic Problem Solving on Phytagoras Theorem Material [Analisis Kemampuan Metakognisi Ditinjau Dari Pemecahan Masalah Matematis Siswa Pada Materi Teorema Phytagoras]', Journal of Authentic Research on Mathematics Education (JARME), 4(1), pp. 57–65. doi: 10.37058/JARME.V4I1.3147.

Jailani et al. (2020) 'High school students' difficulties in making mathematical connections when solving problems', International Journal of Learning, Teaching and Educational Research, 19(8). doi: 10.26803/ijlter.19.8.14.

Mayasari, & Rosyana, T. (2019). "The Effect of Independent Learning on Mathematical Problem-Solving Ability of Junior High School Students in Bandung City [Pengaruh Kemandirian Belajar Terhadap Kemampuan Pemecahan Masalah Matematis Siswa SMP Kota Bandung]". Jurnal Cendekia : Jurnal Pendidikan Matematika, 3, 82 – 89.

NCTM. (2000). "Principle and Standards for School Mathematics". USA : The National Council of Teachers Mathematics, Inc.

Permendikbud. (2016). Peraturan Mentri Pendidikan dan Kebudayaan Nomor 21 Tentang Standar Isi Pendidikan Dasar Dan Menengah.

Polya, G. (1988). "How To Solve It : A New Aspect of Mathematical Method". Princeton NJ : Princeton University Press.

Rodliyah, S.A., Abidin, Z., & Syaifuddin. (2018). " Analysis of Problem Solving Ability Based on Self-Regulated Learning on Social Arithmetic Materials for Class VII Students of SMPN 5 Karangploso [Analisis Kemampuan Pemecahan Masalah Berdasarkan Kemandirian Belajar (Self-Regulated Learning) pada Materi Aritmatika Sosial Peserta Didik Kelas VII SMPN 5 Karangploso]". JP3 (Jurnal Pendidikan, Penelitian dan Pengabdian), 16, 163 – 175.

Sapitri, Y., Utami, C., & Mariyam. (2019). "Analysis of Students' Mathematical Problem Solving Ability in Solving Open-Ended Problems on Circle Materials in View of Learning Interest [Analisis Kemampuan Pemecahan Masalah Matematis Siswa dalam Menyelesaikan Soal Open-Ended pada Materi Lingkaran Ditinjau dari Minat Belajar]". Jurnal Variabel, 2, 16 – 23.

Sriwahyuni, T. (2019). "Analysis of the Mathematical Communication Ability of Junior High School Students on the Material of Quadrilaterals and Triangles [Analisis Kemampuan Komunikasi Matematis Siswa SMP Pada Materi Segiempat Dan Segitiga]". Jurnal Kajian Pembelajaran Matematika, 3, 18–23.

Sulistyani, D., Roza, Y., & Maimunah. (2020). " The Relationship of Independent Learning with Mathematical Problem Solving Ability [Hubungan Kemandirian Belajar dengan Kemampuan Pemecahan Masalah Matematis]". Jurnal Pendidikan Matematika, 3, 1 - 12.