
Profile of Mathematical Understanding of Junior High School Students in View of Self-Efficacy

Maria Adelisa Manbait^{a*}, Maria Gracia Manoe Gawa^b, Irmina Veronika Uskono^c,
Agapitus Hendrikus Kaluge^d

^{a,b,c,d}Universitas Katolik Widya Mandira, St. San Juan No. 1, East Penfui, East Nusa Tenggara, Kupang 85111, East Nusa Tenggara

*Email: mariamambait685@gmail.com

Abstract

The objective of this study is to depict the comprehension of mathematics among junior high school students in the context of self-efficacy. The research employs a qualitative descriptive approach. The research participants consist of two students from Class VII at SMP IL Captain Fatuba'a, with one student having a high level of self-efficacy and the other student having a low level of self-efficacy. Data collection encompasses the use of self-efficacy questionnaires, problem-solving assignments, interviews, and data triangulation. The data analysis process involves employing techniques such as data reduction, data presentation, and drawing conclusions. The indicators used to assess the understanding of mathematics in this study comprise the ability to restate concepts, utilize specific procedures or operations, and apply concepts or algorithms in problem-solving. The findings reveal that subjects with high self-efficacy successfully fulfilled all these indicators, while subjects with low self-efficacy only managed to fulfill the first indicator of restating the concept. Consequently, it can be inferred that subjects with high self-efficacy are capable of fulfilling all the indicators, whereas subjects with low self-efficacy are limited to fulfilling only one indicator. As a result, it is crucial for teachers to take into account students' mathematical understanding abilities when conducting classroom instruction.

Keywords:

profile, mathematical understanding, self-efficacy

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1. Introduction

Mathematics learning has a significant role in everyday life. One of the main objectives of learning mathematics is to develop the ability to overcome and solve problems. Solving mathematical problems requires more memorization. Kadafuk et al (2020) explained that students are not only expected to hear, memorize, and store the material taught but also must have the ability to solve various mathematical problems. Burhan (Wulandari & Hidayati, 2019) also argues that mathematics has no meaning if it is only memorized, but a good understanding by students allows them to understand the concept of the lesson more deeply. This means that understanding mathematics facilitates students' ability to solve problems. Qohar (Mulyani et al 2018) explained that mathematical understanding involves the ability to explain objects in mathematics, interpret ideas or concepts, find examples of these concepts, provide examples and contrapositives, and re-express mathematical concepts in their own words. Understanding mathematics makes it easier for students to solve problems because they

are able to connect and apply the concepts they understand well. One of the affective aspects of students that is important in solving math problems is self-efficacy.

Self-efficacy has a significant impact on student's ability to complete tasks and solve problems. Sunaryo (2017) said that self-efficacy is an important belief for students to achieve success in the learning process. Uran et al (2019) also revealed that self-efficacy is the belief that each student has the ability to perform activities or tasks with the goals to be achieved. However, Nahdi (Nurani et al., 2021) revealed that in practice, students often lack the confidence that they are able to solve the problems they face, as a result, they are unable to achieve academic achievement according to their potential. One of the factors is students' lack of confidence in their ability to do tasks. This is in line with the findings of Fitri (2017) which states that students with low self-efficacy tend to copy a lot of homework and copy friends' answers. In addition, in the process of learning mathematics, students often face uncertainty about their answers.

There are differences between students who have a high level of self-efficacy and students who have a low level of self-efficacy. Students who have a high level of self-efficacy are students who believe that they are able to complete the assigned tasks. Muallifah (2016) explains that students with high self-efficacy tend to be more independent and confident in their ability to complete tasks, and do not engage in negative learning behaviors such as copying other people's work or plagiarism.

In learning mathematics, students' level of mathematical understanding is related to self-efficacy. When students understand what they are learning without memorizing, they will be able to do or complete a task. This shows that someone who already understands will have self-efficacy so that they can do something that will allow them to be more confident.

Based on observations in class VII of SMP IL Kapten Fatuba'a, researchers obtained information that there are still students who only memorize examples of concepts in solving math problems without understanding them. In addition, students also do not believe in their own abilities, so they have difficulty solving problems. Therefore, this research question is how are the characteristics of mathematical understanding of junior high school students can be associated with the level of self-efficacy? Thus, the purpose of this study is to describe the mathematical understanding of junior high school students by considering their level of self-efficacy.

2. Literature Review

2.1. *Mathematical Understanding*

Understanding refers to a person's ability to understand something after knowing and remembering it (Sudijono, 2016). Understanding involves a person's ability to explain a situation or action. In other words, understanding occurs when someone understands something that has been known and is able to explain the situation or action (Ridia & Afriansyah, 2019). Santrock (Septiyani & Alyani, 2021) explains that mathematical understanding is a very important basis for students in learning mathematics and is a necessary foundation for solving problems. Lestari & Yudhanegara (Indriani & Hariastuti, 2017) state that mathematical understanding involves a person's ability to understand and absorb mathematical ideas. Based on these views, it can be concluded that mathematical understanding is a person's ability to understand and internalize mathematical ideas applied in problem-solving.

According to O'Connel (Mulyani et al., 2018), mathematical understanding makes it easier for students to solve problems because they can connect and apply the concepts

they have understood in solving problems. Qohar (Himawan & Setiyani, 2022) explains that mathematical understanding involves the ability to decompose mathematical objects, interpret ideas or concepts, find examples of concepts, provide examples and non-examples, and re-express mathematical concepts in their own words. This means that mathematical understanding makes it easier for students to solve problems because they can relate, explain mathematical objects, find examples of a concept, give examples and non-examples, and solve problems using concepts that are simple and easy to understand.

Students' success in solving problems can be determined by indicators of mathematical understanding, which include (1) the ability to re-express a concept, (2) the ability to use, utilize, and select specific procedures or operations, and (3) the ability to apply concepts or algorithms in solving problems.

2.2. Self-efficacy

Self-efficacy is a person's belief or confidence in their ability to organize, complete tasks, achieve goals, produce something, and act to achieve certain skills.

According to Ormrod (Ananda & Wandini, 2022), self-efficacy refers to an individual's belief in their ability to carry out specific behaviors or achieve certain goals. Another opinion expressed by Woolfolk (Apriyeni & Rozali, 2021) states that self-efficacy is an individual's assessment of himself or his level of confidence in handling certain tasks well. Alwisol (Noviawati, 2016) explains that self-efficacy is an individual's assessment of his ability to do good or bad, right or wrong actions, and whether he is able to carry out what is required of him. Baron and Byrne (Lidya & Darmayanti, 2015) define self-efficacy as an individual's belief in ability or competence in carrying out certain tasks, achieving goals, or overcoming obstacles. Thus, self-efficacy refers to an individual's activity in performing actions well or badly, right or wrong, and whether he is able or unable to achieve goals or overcome obstacles according to existing requirements. In other words, self-efficacy is an individual's belief or conviction in his or her ability to complete tasks and achieve certain goals without obstacles.

According to Fitri (Nurani et al., 2021), a lack of self-efficacy can be observed in the number of students who copy homework from classmates. In contrast, students who have a high level of self-efficacy feel challenged when given more difficult problems. Suraryo (Nurani et al., 2021) stated that having high self-efficacy encourages students to be serious and diligent in learning and working on math problems. In addition, according to Uran et al. (2019), high self-efficacy can increase confidence to achieve success, while students with low self-efficacy may not want to try to study for exams because they believe that studying will not help them in solving problems. Therefore, it can be concluded that students who have low self-efficacy tend to be unable to solve difficult math problems, while students with high self-efficacy will try harder to solve these problems. Bandura (Subaidi, 2016) explains that there are three dimensions of self-efficacy used to measure individual self-efficacy, namely magnitude, strength, and generality.

1.1.1. *Magnitude*

Magnitude refers to the level of task difficulty that a person perceives when performing the task. When facing a task with a certain level of difficulty, a person's self-efficacy level tends to decrease, even for tasks that are considered easy, moderate, or difficult

according to their abilities. This factor affects the choice of behaviors they will try or avoid. A person will tend to try behaviors that they perceive they can do well, while they will avoid behaviors that seem out of their range of abilities.

1.1.2. *Strength*

Strength refers to the level of strength or weakness of an individual's belief in their own abilities. Individuals who have strong self-efficacy tend to be persistent and unyielding in their efforts to improve their performance, even when facing severe obstacles. On the other hand, individuals with weak self-efficacy tend to be vulnerable to the negative influence of small obstacles in carrying out their tasks.

1.1.3. *Generality*

Generality refers to the extent of the scope of the task area being performed. In terms of handling or completing their tasks, there are individuals who have beliefs that are limited to certain actions and situations, while there are also individuals who have beliefs that cover a variety of different actions and situations.

Thus student self-efficacy can be measured by three dimensions, namely magnitude, strength, and generality. The three dimensions can be used in measuring the level of student difficulty, strength, and generalization of students in doing tasks or solving problems related to mathematics. Self-efficacy indicators can be seen in Table 1.

Table 2. 1 Self-efficacy indicators

Aspects	Indicators
Magnitude	1. A person's belief in their ability to deal with the difficulty of a task. 2. Determination of behavior based on the obstacles or difficulties present in the task.
Strength	An individual's level of strength or expectation of their own abilities.
Generalisasi	An individual's belief in their ability to perform tasks in various activities.

3. Method

The method used in this research is descriptive qualitative. The research subjects consisted of two students who were in class VII at IL Kapten Fatuba'a Junior High School. Subjects were selected based on high and low ability levels, which have been measured using the self-efficacy measurement method conducted by (Azwar, 2021).

Table 3. 1 Self-efficacy measurement results of students of SMP IL Kapten Fatuba'a

Category	Interval	Frequency	Percentage
High	$20 > X$	31	82%
Medium	$10 \leq X < 20$	5	13%
Low	$X < 10$	2	5%
Total		38	100%

Source: Researcher, 2023

The procedure of this study consisted of several stages. The preparation stage involved the preparation of problem-solving task instruments, interview guidelines, and self-efficacy questionnaires. At the implementation stage, the research subjects were given problem-solving tasks, and the results were analyzed based on mathematical understanding indicators. The final stage of the research involved processing the data of the research results. The instruments used in this study consisted of the researcher himself who was responsible for data collection, analysis, and interpretation. In addition, problem-solving tasks and interview guidelines as supporting tools in this study.

The data collection techniques used include the use of self-efficacy questionnaires, problem-solving tasks, and interviews. To ensure the validity of the research data, time triangulation was used by asking two similar questions at two different times.

The data analysis technique consists of data reduction, data presentation, and conclusion drawing. Data reduction is done to organize and sort the data that has been collected to make it more organized. After that, the data is presented in a more structured and concise form so that it can be more easily understood. The final step is drawing conclusions based on the results of the data analysis that has been carried out.

4. Results and Discussion

Results

The instrument used in this study consisted of two problem-solving problems of equal difficulty. Detailed information about the two sets of problem-solving problems of equal difficulty can be found in Table 3.

Table 4. 1 Problem-Solving Task

TPM I	TPM II
Intan bought 5 kg of sugar at a price of Rp. 13,000/kg. Then she sold the sugar for Rp. 15,000/kg. Calculate:	Mey bought 20 kg of rice at a price of Rp. 12,500/kg. Then Mey sold the rice for Rp. 15,000/kg. Calculate:
a. The amount of profit earned if the sugar is sold per kilogram.	a. The amount of profit earned if the rice is sold per kilogram.
b. The percentage of profit	b. The percentage of profit.

The process of selecting research subjects was based on self-efficacy measurements, involving one student with a high self-efficacy level and one student with a low self-efficacy level. More information about the research subjects can be found in Table 4.

Table 4. 2 Selection of Research Subjects

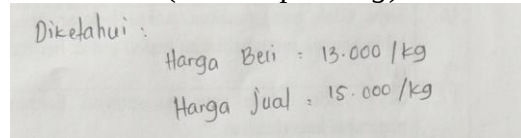
No	Student Name	Self-efficacy Score	Category
1.	D S M	25	High
2.	U B T	10	Low

Students with high self-efficacy

The following are excerpts of interview results on TPM 1:

P104 : “What is known from the question?”

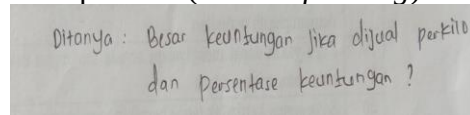
T104 : “The known (*while explaining*)”



Diketahui :
 Harga Beli : 13.000 /kg
 Harga Jual : 15.000 /kg

P105 : “Okay. What does the question ask?”

T105 : “The question (*while explaining*)”



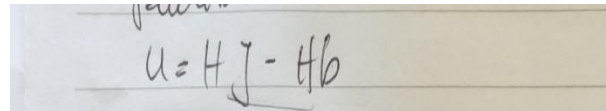
Ditanya : Besar keuntungan jika dijual per kilo
 dan persentase keuntungan ?

P106 : “How did you know that this question is about profit?”

T106 : “From the question, because the selling price is higher than the buying price”

P107 : “How do you know that Intan made a profit of Rp.2,000.00/kg?”

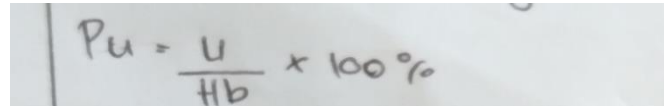
T107 : “Because I used the formula”



$U = HJ - HB$

P108 : “Then how do you find the percentage of profit?”

T008 : “I used the formula”



$Pu = \frac{U}{HB} \times 100\%$

P109 : “Okay, then where did you get 15.38% from?”

T109 : “I got it from (*as written*)”



$\frac{200.000}{13.000}$

P110 : “Explain the working steps, please”

T110 : “(*while explaining*)”

Diketahui :

$$\text{Harga Beli} = 13.000 / \text{kg}$$

$$\text{Harga Jual} = 15.000 / \text{kg}$$

Ditanya : Besar keuntungan jika dijual perkilo dan persentase keuntungan ?

Jawab :

a) Besar Keuntungan

$$U = HJ - HB$$

$$= 15.000,00 - 13.000,00$$

$$= 2.000,00$$

Jadi, besar keuntungan jika dijual perkilo adalah Rp. 2.000,00

b). Persentase Keuntungan

$$Pu = \frac{U}{HB} \times 100 \%$$

$$= \frac{2.000}{13.000} \times 100 \%$$

$$= \frac{200.000}{13.000}$$

$$= 15,38 \%$$

Jadi, Persentase keuntungannya adalah 15,38 %

The following are the results of the interview excerpts on TPM 2:

P206 : "What is known from the question?"

T206 : "The known (while explaining)"

Dik.

$$\text{Harga Beli} = 13.500,00 / \text{kg}$$

$$\text{Harga Jual} = 15.000,00 / \text{kg}$$

P207 : "Okay. What does the question ask?"

T207 : "The question (while explaining)"

Dit. Besar keuntungan jika dijual perkilo dan persentase keuntungan ?

P208 : "How did you know that this question is about profit?"

T208 : "From the question, because the selling price is higher than the buying price"

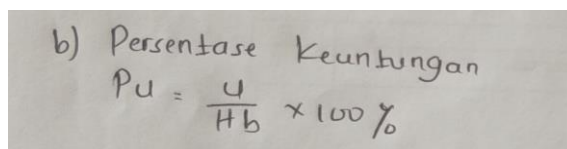
P209 : "How do you know that Intan made a profit of Rp.2,500.00/kg?"

T209 : "Because I used the formula"

$$U = HJ - HB$$

P210 : "Then how do you find the percentage of profit?"

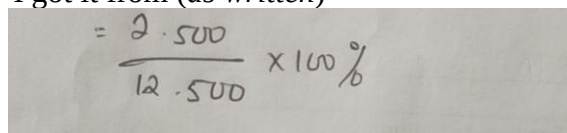
T210 : "I used the formula"



$$b) \text{ Persentase Keuntungan} \\ P_u = \frac{U}{H_b} \times 100\%$$

P211 : "Okay, then where did you get 20% from?"

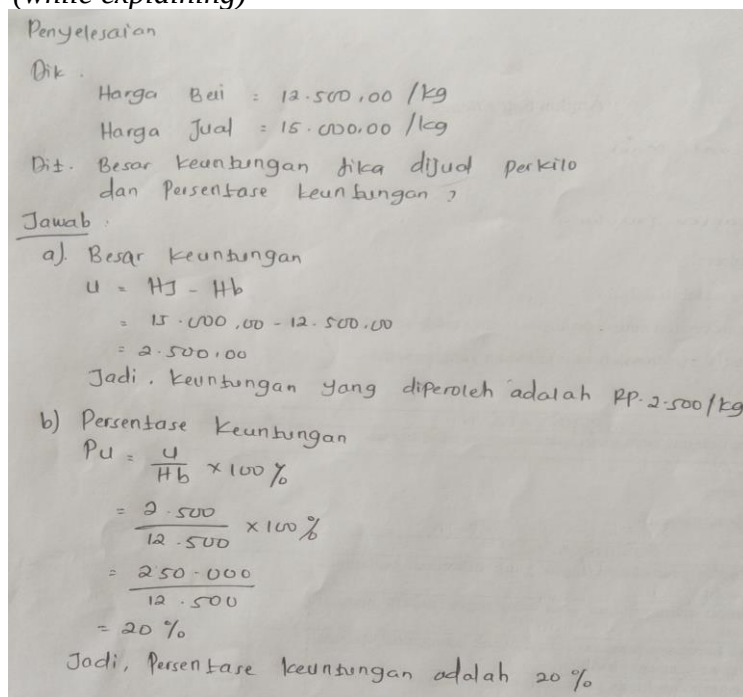
T211 : "I got it from (as written)"



$$= \frac{2.500}{12.500} \times 100\%$$

P212 : "Explain the working steps, please"

T212 : "(while explaining)"



Penyelesaian

Dik. :
 Harga Beli = 12.500,00 / kg
 Harga Jual = 15.000,00 / kg

Dit. : Besar keuntungan jika dijual per kilo dan persentase keuntungan?

Jawab :

a). Besar keuntungan
 $U = H_J - H_b$
 $= 15.000,00 - 12.500,00$
 $= 2.500,00$
 Jadi, keuntungan yang diperoleh adalah Rp. 2.500/kg

b) Persentase Keuntungan
 $P_u = \frac{U}{H_b} \times 100\%$
 $= \frac{2.500}{12.500} \times 100\%$
 $= \frac{250.000}{12.500}$
 $= 20\%$
 Jadi, persentase keuntungan adalah 20%

To test the validity of concept information in students' mathematical understanding based on self-efficacy, subjects with high self-efficacy in indicators of repeating a concept, using, and applying specific procedures or operations, and applying concepts or algorithms in solving TPM I and TPM II problems, using time triangulation. Time triangulation is used to find similarities or data correlations between TPM I and TPM II. Details about this can be found in Table 4. 5.

Table 4. 5 Data Validity

TPM I	TPM II
The subject is able to determine what is known and questioned in the problem, the subject can explain that the selling price is higher than the purchase price which states the profit (T106, T107, T108).	The subject is able to determine what is known and questioned in the problem, the subject can define that the selling price is higher than the purchase price states the profit (T206, T207, T208).

The subject was able to solve the problem by using the formula. The subject was able to solve the problem by using the formula "selling price - purchase price" to calculate the profit and $\frac{\text{untung}}{\text{harga Beli}} \times 100\%$ to calculate the percentage of profit. Then for the result of the percentage of the profit of 15.38% the subject got from $\frac{200.000}{13.000}$ (T109, T110, T111).

The subject knows how to solve the problem with the correct and sequential steps (T112).

The subject was able to solve the problem by using the formula. The subject was able to solve the problem by using the formula "selling price - purchase price" to calculate the profit and $\frac{\text{untung}}{\text{harga Beli}} \times 100\%$ to calculate the percentage of profit. Then for the result of the percentage of the profit of 15.38% the subject got from $\frac{250.000}{12.500}$ (T209, T210, T211).

The subject knows how to solve the problem with the correct and sequential steps (T212).

Based on the triangulation results, it can be seen that subjects with high self-efficacy are consistent in expressing their abilities in the indicators of restating concepts, using and applying specific procedures or operations, and applying concepts or algorithms in problem-solving at TPM I and TPM II. Thus, the data showing the ability in the indicators of restating concepts, using and utilizing specific procedures or operations, and being able to apply concepts or algorithms in solving problems at TPM I are considered valid.

1.1.4. Students with low self-efficacy

The following is an excerpt of the interview results on TPM I:

P106 : "What is known from the question?"

R106 : "The known (while explaining)"

Dik: HB = Rp. 13.000,00/kg
HJ = Rp. 15.000.00/kg

P107 : "Okay. What does the question ask?"

T107 : "The question (while explaining)"

Dit: udan pu%

P108 : "How do you know that Intan made a profit of Rp.2,000.00/kg?"

T108 : "Because I used the formula"

Penyelesaian: HB = HJ

P109 : "Then how do you find the percentage of profit?"

R109 : "I don't know"

b. Persentase keuntungan

P110 : "Explain the working steps, please"

R110 :

Dik: $H_B = \text{Rp. } 13.000,00/\text{kg}$
 $H_J = \text{Rp. } 15.000,00/\text{kg}$
 Dit: u dan $pu\%$
 Penyelesaian: $H_B - H_J$
 $= 13.000 - 15.000$
 $= -2.000$ jadi keuntungan yang diperoleh adalah -2.000
 b. Persentase keuntungan

The following is an excerpt of the interview results at TPM II:

P206 : "What is known from the question?"

R206 : "The known (while explaining)"

Dik: $H_B = 12.500$
 $H_J = 15.000$

P207 : "Okay. What does the question ask?"

T207 : "The question (while explaining)"

Dit: u dan $pu\%$

P208 : "How do you know that Intan made a profit of Rp.2,500.00/kg?"

T208 : "Because I used the formula"

Penyelesaian: $H_B - H_J$

P209 : "Then how do you find the percentage of profit?"

R209 : "I don't know"

b. Persentase keuntungan

P210 : "Explain the working steps, please"

R210 :

Dik: $H_B = 12.500$
 $H_J = 15.000$
 Dit: $u dan P\%$
 Penyelesaian: $H_B = H_J$
 $= 12.500 - 15.000$
 $= -2.500,00$
 Jadi keuntungan yang diperoleh adalah -2500
 b. Persentase keuntungan

To test the validity of concept information in students' mathematical understanding based on self-efficacy, subjects with low self-efficacy in indicators of re-expressing a concept, using, and utilizing special procedures or operations, and applying concepts or algorithms in solving problems. TPM I and TPM II, using triangulation. Time triangulation is used to find similarities or data correlations between TPM I and TPM II. These details can be found in Table 4. 6.

Table 4. 6 Data Validity

TPM I	TPM II
The subject was able to determine what was known and asked in the problem (R106, R107).	The subject was able to determine what was known and asked in the problem (R206, R207).
The subject was mistaken in using the formula used to calculate the profit was not appropriate (reversed) so the results obtained were wrong, the subject also did not finish solving the problem (R108, R109).	The subject was mistaken in using the formula used to calculate the profit was not appropriate (reversed) so the results obtained were wrong, the subject also did not finish solving the problem (R208, R209).
The subject did not solve the problem using the steps of the work so it was not resolved (R110).	The subject did not solve the problem using the steps of the work so it was not resolved (R210).

Based on the triangulation results, it can be seen that subjects with low self-efficacy are consistently able to repeat a concept, use and utilize specific procedures in operations, and apply concepts or algorithms in solving problems at TPM I and TPM II. So, the data showing the subject's ability to re-express concepts, use and utilize specific procedures or operations, and apply concepts or algorithms in solving problems at TPM I is considered valid.

Discussion

Students who have high self-efficacy are able to fulfill all three indicators in solving problem-solving problems. Students have the ability to re-express a concept by

recognizing existing information and responding to the questions asked. In addition, they can use, utilize, and select special procedures or operations by using appropriate formulas. The subjects were also able to apply concepts and algorithms in problem-solving by following the right steps. This finding is in line with Suraryo's statement (Nurani et al. 2021) which states that high self-efficacy encourages students to study diligently and seriously, and can complete mathematics tasks. Uran et al. (2019) also stated that students with high self-efficacy have increased confidence to achieve success. This shows that students with high self-efficacy have high motivation to learn and are able to complete tasks to achieve success.

Students with low self-efficacy can only fulfill the first indicator, namely restating concepts. However, students have difficulty in using, utilizing, and selecting certain procedures or operations, thus failing to solve the problem. In addition, students are also unable to apply concepts or algorithms in problem-solving based on the correct steps. This finding is in line with the statement of Uran et al. (2019) who stated that students with low self-efficacy may not have the motivation to study before the exam because they believe that studying will not help them in solving exam questions. In addition, Fitri (2017) also stated that low self-efficacy can be observed from the fact that most students do homework at school and look at their friends' answers.

5. Conclusion

Based on the findings and discussion that have been presented, it can be concluded that individuals who have a high level of self-efficacy are able to fulfill all the indicators that have been set. These individuals are able to restate concepts, use and utilize specific procedures or operations, and are able to apply concepts or algorithms in solving problems. On the other hand, students who have low self-efficacy are only able to fulfill the first indicator, namely restating the concept. In all three indicators, individuals with high self-efficacy showed better ability in understanding, using, and applying mathematical concepts in problem-solving. In contrast, individuals with low self-efficacy have limitations in the use and application of these concepts.

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