

## SELF-EFFICACY ANALYSIS OF STUDENTS' MATHEMATICAL PROBLEM-SOLVING ABILITY IN ABSOLUTE VALUE EQUATIONS MATERIALS

Fitria Handayani<sup>1</sup>, Yulyanti Harisman<sup>2</sup>, Armiati<sup>3</sup>

<sup>1,2,3</sup> Universitas Negeri Padang

Email: <sup>1)</sup> [phandayanializar@gmail.com](mailto:phandayanializar@gmail.com) [yulyanti\\_h@fmipa.unp.ac.id](mailto:yulyanti_h@fmipa.unp.ac.id) [armiati@fmipa.unp.ac.id](mailto:armiati@fmipa.unp.ac.id)

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### Abstract

Participants can profit from the ability to solve issues by first understanding them, then choosing the best technique, and then applying it to problems in both mathematical and non-mathematical situations. Many variables contribute to students' inability to answer mathematical questions, one of which is a lack of confidence in their abilities. The purpose of this study is to describe how well-equipped pupils are to deal with arithmetic challenges associated with absolute value equations. Study participants were selected from each level after each level's self-efficacy was assessed using questionnaires. The tools used in data collection procedures, which are training tactics, include short interviews, self-efficacy questionnaires, and assessments of one's ability for solving mathematical problems. The data processing and analysis process have three stages: data reduction, data presentation, and conclusion-making. The research subjects were three students from each of the three self-efficacy levels—very high, high, and medium—and their propensities for resolving mathematical puzzles were then evaluated. Students with a very high level of self-efficacy perform mathematical problem-solving tasks more effectively than students with high and medium levels of self-efficacy.

**Keywords:** Mathematical; Problems by understanding the issue; Self Efficacy

### INTRODUCTION

Every level of school requires students to take mathematics, demonstrating the subject's significance to education (Melinda & Surya, 2017; Muhammad et al., 2009; Siagian, 2016) In addition to developing logical thinking skills, mathematics also develops analytical, and critical thinking, and creative thinking abilities. It is intended that through learning mathematics, those who study it would be able to work effectively to solve the difficulties of modern life (Sulistiani, 2016)

However, mathematics is a subject that is regarded as complex and difficult to understand. According to the findings of the 2018 Program for International Student Assessment (PISA) study survey, which was issued by the Ministry of Education and Culture Website (Pengelola Web Kemendikbud, 2019; Tohir, 2019), Indonesia is rated 73rd or 7th. from the bottom, of all the countries that took the exam, with an average score of 379. This number is quite far behind compared to China's average score of 591, which continues to hold the top spot. One of the causes contributing to Indonesian students' low PISA scores is their lack of mathematical problem-solving abilities when answering non-routine or high-level problems.

According to Zulfitri (Syaras Mita et al., 2019), students need to possess problem-solving skills to be trained in handling issues in both the mathematics classroom and other areas of daily life. This training includes the ability to comprehend problems, select the best approach, and then be able to use it to solve them. According to Cohen (Harisman & Khairani, 2021), problem-solving is described as a type

of mental activity aimed at reaching objectives, getting over hurdles, or coming up with fresh approaches to issues that have already been resolved uniquely.

According to NCTM (Harahap & Surya, 2017), issue-solving is the practice of applying previously learned information to new and distinct contexts. According to Polya, four steps are used as the foundation for solving a problem (Amalia & Napitupulu, 2018; Simatupang & Napitupulu, 2020; Yuwono et al., 2018). The first step is understanding the problem; at this stage, students must identify what is known, what exists, the amount, relationships, associated values, and what they are looking for. (2) Making a Plan: Students are required to list the steps necessary to address a particular problem. (3) Executing the Plan. In this regard, what is carried out depends on what has been planned, translated into mathematical form, and carried out.

However, pupils' poor capacity to answer mathematical problems (Aida et al., 2017; Christina, 2021; Rambe & Afri, 2020) remains a significant "homework" for Indonesian education. One of the reasons for students' poor mathematical aptitude, according to Siswono (Sephthiani, 2022), is that they lack self-confidence (Self Efficacy) when it comes to solving arithmetic issues. According to Wicaksono and Saufi (Disai et al., 2017), high school students experience anxiety when learning mathematics and worry about their readiness for math tests. One of the reasons for this anxiety is that the students believe they are incapable of handling questions. Due to their inexperience with mathematics and lack of preparation, pupils feel unsure of receiving adequate results.

Self-efficacy, according to Woolfolk (Disai et al., 2017), is a person's opinion of himself or his level of confidence in his ability to carry out a task and produce a specific outcome. According to Bandura (Disai et al., 2017; Sari et al., 2021; Septhiani, 2022), self-efficacy is the conviction that one can exert control over the circumstances that are confronting them. Where Bandura claims that each person's self-efficacy has three key dimensions, namely: A dimension related to task difficulty is called level (a). When given the choice between tough and easy jobs, people with high self-efficacy are more likely to pick the latter. (b) Generality, or the conviction that specific jobs should be carried out completely and skillfully. This connects to personal success domains including time management, material mastery, and task mastery. (c) Strength is a factor that is closely related to how strongly people hold their opinions. This entails being persistent in your learning, persistent in finishing your work, and consistent in your goal-achieving.

Solving problems involving the absolute value equation of the linear form of one variable is one of the new topics covered in Ministerial Regulation (Permendikbud, 2018) Number 37 of 2018, which addresses Basic Competence in Mathematics for Class X. This material has not yet been introduced at the junior high school (SMP) level. An implicit idea, the absolute value equation of the linear form of one variable is stated as a piecewise function, namely  $|x| = \begin{cases} x, & \text{if } x \geq 0 \\ -x, & \text{if } x < 0 \end{cases}$ . Because it combines multiple formulas in a function description, this concept can be challenging for students to understand and apply. Brumfiel in (Widyaningsih, 2019). Learning information that calls for absolute value as a requirement, such as absolute value equality and inequality, may be hampered by the concept of absolute value (Widyaningsih, 2019).

The researcher is interested in performing a study titled "Self-Efficacy Analysis of Students' Mathematical Problem Solving Ability in Material Absolute Value Equations" based on the background information provided above.

## METHOD

The research method employed is descriptive research, which is also known as a research method that explains or describes a symptom, event, or scenario that is researched in depth and is related to data gathering to address concerns regarding the issue under study. in the form of word descriptions (Lufri, 2005). Three students from class X MA were chosen as subjects for this study based on their self-efficacy test scores from when questionnaires were given out. Purposive sampling was employed for the sampling process (Lufri, 2005), and questionnaire results were used to identify representatives of each degree of self-efficacy. Indicators for this study's initial data collection on student self-efficacy were created based on questionnaire data.

**Tabel 1.** Student Self Efficacy Indicator

Dimensi	Deskripsi	Indikator
<i>Level</i>	Associated with how individual beliefs depend on how challenging a task is	1) Students are seeking solutions to challenging assignments 2) Students don't want to avoid assignments that they think are too difficult.
<i>Strength</i>	Considering his level of personal commitment to completing the mission	1) Students persist in their efforts despite challenges and setbacks 2) Students don't lose confidence after encounters that don't live up to expectations
<i>Generality</i>	Having to do with the person's capacity to apply knowledge from one task to many different others.	1) Students believe they can execute tasks in a variety of activities. 2) Students have faith in their capacity to finish tasks in a range of circumstances.

Source : (Imaroh et al., 2021)

Table 1. There are six markers of self-efficacy, however, the researcher's self-efficacy questionnaire was developed into ten questions with four scale categories: scale 4 extremely high, scale 3 high, scale 2 medium, and scale 1 low. The respondent can receive a maximum of 40 points and a minimum of 10. The questionnaire data is then examined to determine the student category based on their level of self-efficacy. Based on the range of scores, Table 2 displays the level of self-efficacy.

**Table 2.** Category of Self-Efficiency Level

No	Score Range	Level
1	$34 \leq x \leq 40$	Very high
2	$26 \leq x \leq 34$	High
3	$18 \leq x \leq 26$	Medium
4	$10 \leq x \leq 18$	Low

Source : (Imaroh et al., 2021) after modifying the scale that the researcher utilized

A test of mathematical problem-solving skills using the subject matter of one variable linear absolute value equations will be the next data collection. The following is a list of test questions for problem-solving:

1. Determine the solution to the absolute value equation  $|x - 7| = 3$
2. Determine the solution to the absolute value equation  $|2x - 3| - 1 = 0$

## RESULT AND DISCUSSION

### Result

The levels of self-efficacy are determined based on the analysis of the responses to the student self-efficacy questionnaire, and they are shown in Table 3.

**Table 3.** Student Self-Efficacy Levels

Type	Self Efficacy Levels				cumulative
	Verry High	High	Medium	low	
Subjects	4	11	4	0	19
Percentage (%)	21.05	57.89	21.05	0	100,00

Table 3 students responded to the self-efficacy survey, as can be shown. There are 4 students in the very high-level group, with a self-efficacy level of 21.05%, 3 students in the high-level category, with a self-efficacy level of 57.89%, 4 students in the moderate-level category, with a self-efficacy level of 21.05%, and no students in the low-level category.

Table 4 below provides a list of research subjects as well as the categories of self-efficacy levels and results of mathematical problem-solving tests.

**Table 4.** List of research subjects' names and codes

No	Subject initials	Self-Efficacy Level	Subject Code	Score
1	AK	Very high	ST	91
2	ZN	High	T	76.5
3	RM	Medium	S	15
4	-	Low	-	-

Table 4 lists the subjects' starting names and topic codes according to the student's level of self-efficacy and their success in solving mathematical problems. Specifically, a score of 91 indicates a very high level of self-efficacy for students with the subject code ST, a score of 76.5 indicates a high level of self-efficacy for students with the subject code T, and a score of 15 indicates a moderate level of self-efficacy for students with the subject code S. Following that, Figure 1 will provide the answer sheet for the math problem-solving test for each subject with a very high level of self-efficacy, i.e., subjects with the ST code.

Jawab :

$$\begin{array}{l}
 1. |x-7| = 3 \\
 \begin{array}{l}
 a. x-7 = 3 \\
 x = 10
 \end{array}
 \end{array}
 \quad
 \begin{array}{l}
 b. -(x-7) = 3 \\
 -x+7 = 3 \\
 -x = 3-7 \\
 -x = -4 \\
 x = 4
 \end{array}$$
  

$$\begin{array}{l}
 2. |2x-3|-1 = 0 \\
 \begin{array}{l}
 a. 2x-3 = 1 \\
 2x = 1+3 = 4 \\
 x = \frac{4}{2} = 2
 \end{array}
 \end{array}
 \quad
 \begin{array}{l}
 b. -(2x-3) = 1 \\
 -2x+3 = 1 \\
 -2x = 1-3 \\
 -2x = -2 \\
 x = \frac{-2}{-2} = 1
 \end{array}$$

**Figure 1.** Shows the ST topic problem-solving test's answer sheet

Figure 1 shows the answer sheet for the ST code exam of pupils' ability to solve mathematical problems. ST has not been able to respond to inquiries using Polya's procedures for solving mathematical problems for either number 1 or number 2. ST appears to have skipped the step of comprehending the issue and going over it once more. As can be seen in replies 1 and 2, ST has been able to apply it to problem-solving. ST plans the solution to the absolute value equation by the definition of the equation. ST was successful in carrying out the settlement plan at that point, so ST had an answer for both questions 1 and 2.

**Figure 2.** Answer sheet for the subject T problem-solving test

1.  $|x - 7| = 3$   
 $x - 7 = 3$   
 $x = 3 + 7$   
 $x = 10$

2.  $|2x - 3| - 1 = 0$   
 $|2x - 3| = 0 + 1$   
 $|2x - 3| = 1$   
 $2x - 3 = 1 + 3$   
 $2x = 4$   
 $x = \frac{4}{2}$   
 $x = 2$

Figure 2 shows the answer sheet for the mathematical problem-solving assessment of the pupils. It is evident from the responses to questions 1 and 2 that student T was unable to use the Polya stage for mathematical problem solving, namely in the understanding and reviewing stages. In response to question No. 2, it can be observed that Student T does not plan as well as the answer to question No. 1, which is a problem-solving strategy utilizing the absolute value concept, such that at the implementation stage, the plan for completing answer No.

**Figure 3.** Answer sheet for the subject S problem-solving test

1.  $|x - 7| = 3$   
 $x - 7 = 3$   
 $x = 7 + 3$   
 $x = 10$

2.  $|2x - 3| - 1 = 0$   
 $|2x - 3| = -1 + 0$   
 $|2x - 3| = -1$   
 $2x - 3 = -1$   
 $2x = -1 + 3$   
 $2x = 2$   
 $x = \frac{2}{2}$   
 $x = 1$

Figure 3 shows the answer sheet for the mathematical problem-solving assessment of the pupils. S pupils have also had trouble using the Polya stages to solve mathematical problems, just like ST and T

students have. Student S neglected the phases of grasping the topic and reviewing it. Student S was unable to complete the problem-solving phase of the process adequately, both for responses to questions 1 and 2, which prevented the implementation of the settlement plan from yielding the best possible results. Student S did not correctly answer the question, in the conclusion.

According to the findings of the research mentioned above, pupils with extremely high self-efficacy are better able to answer mathematical problems than those with high and moderate self-efficacy. Similarly to this, students with high self-efficacy are better able to solve mathematical problems than those with moderate self-efficacy. This is consistent with studies by (Gilar Jatisunda, 2017; Imaroh et al., 2021; Septhiani, 2022; Somawati, 2018; Yuliyanti, 2017), which found a link between students' mathematical problem-solving skills and self-efficacy. Higher self-efficacy students typically have more aptitude for solving mathematics problems than students with lower levels of self-efficacy.

Similarly, studies by (Disai et al., 2017; Fitriani et al., 2021; Sari et al., 2021; Yunianti et al., 2016) found that students' learning outcomes in mathematics were positively correlated with their self-efficacy in completing related tasks. Conversely, students' learning outcomes in mathematics were negatively correlated with their self-efficacy in completing related tasks.

It can be inferred from some of the research findings above that self-efficacy is one of the aspects supporting one's capacity to solve mathematical puzzles to improve learning outcomes. While students with low self-efficacy will be pessimistic when faced with hurdles, students with high self-efficacy think that obstacles may be solved by being hopeful and by developing their skills. Nelson (Imaroh et al., 2021)

## CONCLUSIONS AND SUGGESTIONS

Based on data analysis of class X students at one of the Madrasah Aliah Schools in Padang Panjang City, it can be seen that kids with extremely high self-efficacy are superior to students with lower levels of self-efficacy at solving mathematical problems (high and medium). Not all students are capable of solving mathematics problems involving the Polya stages. Data analysis shows that all students cannot also repeat or re-examine the results of the solutions gained in solving mathematical issues, which will affect problem planning and the implementation of problem-solving plans. As a result, the level of students' caution will be affected.

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