

## The Implementation of Immediate Feedback in Problem-based Learning: The Problem-Solving Skill Analysis Seen from Self-Efficacy

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### Abstract

The most common problem encountered by learners in learning mathematics. One of them is - asking questions related to problem-solving. This research described the learners' problem-solving skills via immediate feedback of problem-based learning seen from learners' self-efficacy. This qualitative research took 36 learners of X MIPA 3 at Public Senior High School 2 Grabag, in the academic year 2021/2022. The researchers applied problem-based learning assisted by immediate feedback. The techniques of collecting the data were a test, questionnaire, documentation, and interview. The results showed that the Problem-Solving Skill Test results seen from self-efficacy during the problem-based learning implementation with immediate feedback were varied. The researchers found learners with high self-efficacy had a high problem-solving skill category. Learners with moderate self-efficacy had high, moderate, and low problem-solving skills. Learners with low self-efficacy had low problem-solving skills. In this research, the researchers found no high self-efficacy learners with low problem-solving skill test results or vice versa.

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## INTRODUCTION

Problem-solving refers to the cognitive and psychomotor processes of learners to differentiate problems and solve problems (Karaoglan Yilmaz, 2022). Problem-solving skill is a basic skill to identify problems, consider options, and create the chosen information (Greenstein, 2012). Problem-solving skill is also an individual skill to obtain solutions, solve problems, identify problems, combine some solution stages, and implement the solutions (Fajri et al., 2021).

Problem-solving skill is important for learning mathematics. Somawati (2018) Explains the importance of problem-solving for learning to solve problems. Problem-solving facilitates learners to gain experience from the implementation of their knowledge and skill while solving daily-life problems.

Unfortunately, the mathematics problem-solving skills of learners to work on story questions were low. The same matter was observable in the context of daily life implementation (Gabriella & Imami, 2021; Rahayu & Aini, 2020; Saragih, 2018; Utami & Wutsqa, 2017).

The capability of learners to manage learning problems influenced the learning outcomes. Self-efficacy is an individual capability belief to arrange and formulate actions to manage future situations (Utami & Wutsqa, 2017).

One of the applicable learning approaches to improve mathematics problem-solving skills and self-efficacy is problem-based learning. Problem-based learning, PBL, is a real-life learning approach as the context for learners to improve their problem-solving skills (Masitoh & Fitriyani, 2018). Nurkaeti (2018) explains that problem-based learning provides opportunities for learners to solve problems.

Problem-based learning trains learners to design, think, act creatively, solve realistically, identify, investigate, interpret, evaluate, and stimulate learners to solve problems accurately (Lukito et al., 2019).

Problem-based learning trains learners to solve problems and provide immediate feedback. Immediate feedback is the best method to improve learners' understanding comprehensively and self-reflection (Badyal et al., 2019). The implementation of immediate feedback to improve the process quality and learning outcomes is also useful for mathematics. The objective of providing immediate feedback is to

minimize the occurrence of similar mistakes by highlighting and directly revising the mistakes. (Kurniyawati et al., 2019) explain that PBL is effective for improving mathematics problem-solving skills.

Here are the steps of problem-based learning model implementation with immediate feedback: (1) setting a problem-oriented atmosphere for the learners, (2) organizing the learning activities, (3) guiding the self-directed and group investigations, (4) developing and presenting the works, and (5) analyzing and evaluating the problem-solving process and providing immediate feedback.

Based on the background, this research described the learners' problem-solving skills via immediate feedback of problem-based learning seen from learners' self-efficacy.

## METHOD

The researchers carried out this qualitative research at Public Senior High School 2 Grabag in the academic year of 2021/2022. The researchers took 36 learners of X MIPA 3 at Public Senior High School 2 Grabag, in the academic year 2021/2022. The applied sampling technique was purposive sampling. The researchers collected the data with a test, questionnaire, interview, observation, and documentation. The subjects of the research were based on problem-solving skill tests and self-efficacy questionnaire results.

The researchers grouped the subjects based on the results of the self-efficacy questionnaire distribution as shown in Table 1 (Sudjana, 2005).

**Table 1** the Research Subject Grouping Criteria

Categories	Score Interval
<b>High</b>	$(\bar{x} + s) \leq X$
<b>Moderate</b>	$(\bar{x} - s) \leq X < (\bar{x} + s)$
<b>Low</b>	$X < (\bar{x} - s)$

Remark:

$\bar{x}$  : Mean

s: Standard Deviation

x: The obtained scores

The researchers obtained the problem-solving skill data from the problem-solving skill test and the self-efficacy characters from the self-efficacy questionnaire.

The data analysis of this qualitative research began at the beginning of visiting the research site, during the investigation at the research site, and after collecting the data from the research site (Sugiyono, 2015). Here is the explanation.

The preliminary analysis included the analysis at the beginning of the research, before visiting the research site by collecting secondary data to determine the research focus and validate the research instruments.

The on-site research analysis included the implementation of the Miles & Huberman data analysis method, starting from data reduction, data display, and data verification. Here are the detailed explanations about the on-site research analysis.

(a) data reduction included (1) preparing the learning instrument, such as syllabus, lesson plan, worksheet, self-efficacy questionnaire, and validated problem-solving skill test by experts; (2) assessing the self-efficacy and problem-solving skill test results, (3) determining the research subjects for further interview, and (4) noting and screening valuable findings from the research site.

(b) data display included (1) presenting the data from findings in the forms of tables, graphics, pie charts, etc; (2) presenting the data from the findings in the form of a short essay, inter-category cohorts, etc; and (3) presenting the data from interview results

(c) data verification refers to the process of concluding the research results.

## RESULTS AND DISCUSSIONS

The researchers applied three research instruments, a self-efficacy questionnaire, a problem-solving skill test, and an interview, to describe the learners' problem-solving skills and self-efficacy.

the researchers distributed the questionnaire to identify the self-efficacy characteristics of the learners. The researchers designed the self-efficacy questionnaire based on three dimensions. They were magnitude, strength, and generality (Hendriana et al., 2018). The researchers grouped the self-efficacy characters into high, moderate, and low. Table 2 shows the self-efficacy questionnaire results.

**Table 2** The Self-Efficacy Result Category

Interval	Categories
$72,36 \leq X$	High
$57,63 \leq X < 72,36$	Moderate
$X < 57,63$	Low

Table 3 shows the percentage of self-efficacy questionnaire results.

**Table 31** the Self-Efficacy Questionnaire Result Percentage

Categories	N	Percentage
High	5	14%
Moderate	24	67%
Low	7	19%
Total	36	100%

Table 2 shows 5 learners or 14% of learners have high self-efficacy categories out of 36 learners. The moderate self-efficacy learners consist of 24 learners, 67%. The low self-efficacy learners consist of 7 learners, 19%.

The researchers provided the problem-solving skill test in the face-to-face matter by adhering to the health protocol. In this research, the researchers used written essays for the problem-solving skill test to identify the learners' problem-solving skills. The problem-solving skills were based on four indicators. They were (1) constructing new mathematics knowledge with problem-solving skills, (2) solving problems by implementing mathematics for other contexts, (3) applying and adjusting accurate strategies to solve problems, and (4) observing and reflecting on the mathematics problem process (NCTM, 2003).

The researchers grouped the problem-solving skill test results into high, moderate, and low categories. Table 4 shows the problem-solving skill test results.

**Table 4** The PSKT Result Categories

Interval	Categories
$82 \leq X$	High
$76 \leq X < 81$	Moderate
$X < 75$	Low

Table 5 shows the percentages of the problem-solving skill results.

**Table 52** the Percentages of the Problem-Solving Skill Results

Categories	N	Percentage
High	8	22%
Moderate	13	37%
Low	15	42%
Total	36	100%

Table 5 shows 8 learners out of 36 learners, 22%, have high problem-solving skill test result category. Learners with moderate problem-solving skill result category consist of 13 learners, 37%. Then, learners with low problem-solving skill result category consist of 15 learners, 42%.

From Table 3 and Table 4, the researchers recapitulated the grouping of self-efficacy and problem-solving skill test results. Table 6 shows the recapitulation.

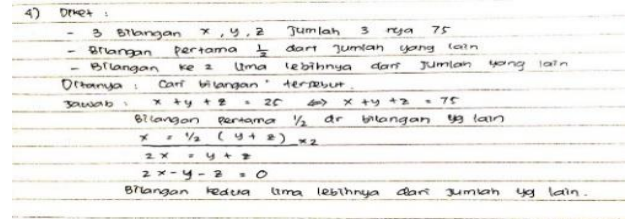
**Table 63** The Grouping Recapitulation of Self-Efficacy Questionnaire and Problem-Solving Skill Test Results

Self Efficacy	Problem-Solving Skill Test		
	High	Moderate	Low
High	5	0	0
Moderate	3	13	8
Low	0	0	7

From Table 6, the researchers selected 6 subjects. They were (1) two learners with high self-efficacy and problem-solving skill category, (2) two learners with moderate self-efficacy and problem-solving skill category, and (3) two learners with low self-efficacy and problem-solving skill category. The researchers labeled the subjects into a first subject (S1), second subject (S2), third subject (S3), fourth subject (S4), fifth subject (S5), and sixth subject (S6). The researchers interviewed the subjects closely based on the interview guidelines. The researchers used the interview results to ensure the self-efficacy character identification with the learners' problem-solving skills. Here are the descriptions of each category.

**The Descriptions of Learners with High Self-Efficacy and Problem-Solving Skills**

The achievements of the subjects, based on high self-efficacy and problem-solving skills, showed that the subjects could understand and master four indicators excellently. However, they encountered difficulties on an unachieved indicator due to limited time allotment. Here is the figure of S2's answer sheet on the fourth question item.



**Figure 1.** the Excerpt of S2's Answer Sheet on the Fourth Item

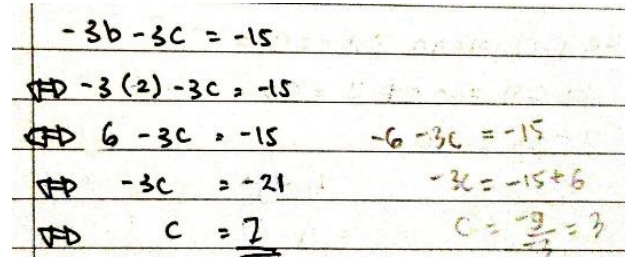
The subject incompletely wrote the answers due to limited time allotment. In the interview, the researcher provided added time for the subject to complete the fourth question item answer with the fourth indicator of problem-solving skill, observing and reflecting on mathematics problems. The results showed that the subject could complete the fourth indicator.

The given feedback was oral simultaneous feedback. The subject received the added time to finish the subject's task while the teacher corrected the answers to figure out the correctness. In this phase, the researchers responded to the correctness of the subject's answers and explored the subject's ideas to find other problem-solving alternatives for the question.

The researchers found 5 learners with high self-efficacy and problem-solving skill categories instead of learners with high self-efficacy categories with moderate and low problem-solving skill categories.

**The Descriptions of Learners with Moderate Self-Efficacy and Problem-Solving Skills**

The researchers found that these learners could understand and master three indicators excellently. Here is the figure of S3's answer sheet on the third question item.



**Figure 2.** the Excerpt of S3's Answer Sheet on the Third Item

The figure shows that the subject still encounters difficulties in calculation due to the incorrect answer accuracy on the third question item. The interview results indicated that the subject thought the answer was correct. However, when the subject and the interviewer rechecked, the researcher found a calculation mistake.

The researchers shared the oral and written immediate feedback. The researchers found the subject's answers were inaccurate. Then, the researchers directed the subject to figure out the calculation mistakes. On the right side, the answer clearly showed the subject's correction. Then, the subject began to revise the answer based on the teacher's guidelines. This action was useful to relieve the doubt of the subject in solving the question.

The researchers found 24 learners had moderate self-efficacy. They were (a) three learners with moderate self-efficacy and high problem-solving skill categories, (b) thirteen learners with moderate self-efficacy and problem-solving skill categories, and (c) eight learners with low self-efficacy and problem-solving skill categories.

### The Descriptions of Learners with Low Self-Efficacy and Problem-Solving Skills

The researchers found that these learners could understand and master two indicators excellently. Here is the figure of S4's answer sheet on the second question item.

eliminasi z dari persamaan 3 dan 4.

$$\begin{array}{r} x + z = 96 \\ y - z = 4 \quad + \\ \hline -2z = 100 \\ z = 50 \end{array}$$

10

$$\begin{array}{r} x + y = 98 \\ x + 50 = 98 \\ \hline x = 48 \end{array}$$

$$\bar{x} = \frac{a+b}{2} \text{ rata-rata}$$

$$\frac{x + (y+z)}{2} = \frac{48+96}{2} = \frac{144}{2} = 72$$

Bagi 2

Jadi, rata-rata berat badan Ari, Soto, Deca adalah 72 kg

**Figure 3.** the Excerpt of S6's Answer Sheet on the Second Item

The answer sheet shows the subject could not understand the concept of the weight of the third person. The interview results showed that the subject did not understand the concept of average. The

subject thought finding the average had to be divided by 2 instead of the numbers of the given data. The subject could not master the second indicator - solving mathematics problems in other contexts.

The researchers shared the oral and written immediate feedback. The researchers determined that the subject's answers were incorrect. Then, the researchers directed the subject to figure out the calculation mistakes. On the right side, the teacher reminded the subject about the average calculation concept. The teachers asked the subject to revise the answers. Unfortunately, the subject thought finding the average had to be divided by 2 instead of the numbers of the given data. Thus, the process was incorrect. In this process, the researchers shared oral and written immediate feedback to guide the subject.

The researchers found seven learners with low self-efficacy and problem-solving skill categories instead of low self-efficacy with high or moderate problem-solving skill categories).

### CONCLUSION

From the analysis and the discussion, the researchers concluded that the achieved problem-solving skills by the tenth graders of Public Senior High School 2 Grabag, seen from self-efficacy during the implementation of problem-based learning with immediate feedback, were varied.

The researchers found learners with high self-efficacy had a high problem-solving skill category. These learners could understand and master four indicators of problem-solving skill tests with oral immediate feedback implementation. Learners with moderate self-efficacy had high, moderate, and low problem-solving skill categories. These learners could understand and master three indicators of problem-solving skill tests with oral and written immediate feedback implementations. Learners with low self-efficacy had low problem-solving skill category. These learners could understand and master two indicators of problem-solving skill tests with oral and written immediate feedback implementations. In this research, the researchers found no high self-efficacy learners with low problem-solving skill test results or vice versa.

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