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High School Students' Mathematical Problem-Solving Ability based on Self-Directed Learning

Kemampuan Pemecahan Masalah Matematis Siswa SMA berdasarkan *Self-Directed Learning*

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Abstract

This research aims to analyze the mathematical problem-solving abilities of class X IPA 1 at SMA As-Suhuf Pamekasan in solving Systems of Linear Equations in Three Variables material through a Self-Directed Learning level. The type of research is descriptive research with a qualitative approach. Class X Science 1 students at As-Suhuf Pamekasan High School were chosen as research subjects. The test used in this research was SPLTV material with 2 questions in essay form. The results of the research based on the data analysis that has been carried out are: (1) students who have mathematical problem-solving abilities with a high level of self-directed learning can fulfill the five problem-solving indicators according to IDEAL, identify problems, define goals, explore possible strategies, anticipate outcomes and act, and look back and learn. (2) students who have mathematical problem-solving abilities with a moderate level of self-directed learning can fulfill the indicators of identifying problems, defining goals, and exploring possible strategies, that other indicators do not meet. (3) students who have mathematical problem-solving abilities with a low level of self-directed learning can fulfill the defined goal indicator and other IDEAL indicators do not fulfill it.

***Keywords**: Mathematic problem solving, Self-Directed Learning.*

Abstrak

Tujuan dari penelitian ini adalah melakukan analisis terhadap kemampuan pemecahan masalah matematis siswa kelas X IPA 1 SMA As-Suhuf Pamekasan dalam menyelesaikan materi Sistem Persamaan Linier Tiga Variabel (SPLTV) berdasarkan tingkatan *Self-Directed Learning*. Jenis penelitian ini adalah penelitian deskriptif dengan pendekatan kualitatif. Siswa kelas X IPA 1 SMA As-Suhuf Pamekasan dipilih menjadi subjek penelitian. Tes yang digunakan pada penelitian ini adalah materi SPLTV dengan sebanyak 2 soal yang berbentuk essai. Hasil penelitian berdasarkan analisis data yang telah dilakukan adalah: (1) siswa yang memiliki kemampuan pemecahan masalah matematis dengan tingkat *self-directed learning* tinggi sudah mampu memenuhi kelima indikator pemecahan masalah menurut IDEAL, *identify problem, define goal, explore possible strategies, anticipate outcomes and act,* dan *Look back dan learn.* (2) siswa yang memiliki kemampuan pemecahan masalah matematis dengan tingkat *self-directed learning* sedang mampu memenuhi indikator i*dentify problem, define goal, Explore possible strategies,* indikator laiinya tidak memenuhi. (3) siswa yang memiliki kemampuan pemecahan masalah matematis dengan tingkat *self-directed learning* rendah mampu memenuhi indikator *define goal* dan indikator IDEAL lainnya tidak memenuhi.

Keywords: Pemecahan masalah matematika, *Self-Directed Learning.*

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INTRODUCTION

Problem solving has an important role in the learning process which enables students to gain understanding, experience, and skills to apply to solving problems in everyday life. Not only routine problems but problem also solving can be used to solve non-routine problems, especially in mathematics learning. Mathematical problem-solving is one of the mathematical activities that is considered important, both by teachers and students at all levels (Akbar et al. 2018; Bernard et al. 2018).

Mathematical problem-solving ability is a student's attempt to use their skills and knowledge to solve mathematical problems (Faizah, et al, 2023; Lanya, et al, 2022). So that students are better trained to solve problems, students can solve problems in the field of mathematics and the context of everyday life. This can be done by carrying out activities that are related to problem solving activities (Suryani et al. 2020; Zahroh et al., 2020).

The mathematical problem-solving abilities possessed by students must be considered so that they continue to be developed. A trial was conducted on one of the students by providing material that had been studied but the student still had difficulty in working on the questions given (Aini, et al, 2020), the factor that caused the student's difficulty was that the student's problem-solving ability was very poor. Students' mathematical problem-solving abilities are one of the abilities needed in learning, teaching, and mathematics itself (Akbar et al. 2018). Therefore, it is important to get special attention to students who have minimal problem-solving abilities. With such conditions, we test students by asking about *Self-Directed abilities.* Student *learning* or what is often understood as independent learning.

Self-Directed Learning (SDL) is the ability of students to take the initiative to be responsible for their learning with or without other people which includes aspects: awareness, learning strategies, learning activities, evaluation, and interpersonal skills (Bagus & Arjaya, 2019). Thus, in learning, students must have the initiative to learn, not depend on other people, have their study schedule, set goals for each learning activity, evaluate the results of their work, and identify their weaknesses and strengths.

Having good *Self-Directed Learning, students have the confidence to convey their mathematical ideas, students who have a study schedule and are consistent with the schedule will have* greater abilities in solving mathematical problems. Having *Self-Directed Learning* can also improve creative, critical, and logical thinking skills (Nailah Zamnah & Meta Ruswana, 2018). Teachers can determine what learning strategies are appropriate to develop and improve students' mathematical problem-solving and *Self-Directed Learning abilities* (Kleden, 2013).

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Based on the importance of mathematical problem-solving abilities and *Self-Directed Learning* In learning mathematics, researchers conducted research with the aim of this research to analyze students' mathematical problem-solving abilities. So, based on the description that has been explained above, the author is interested in conducting research "Analysis of High School Students' Mathematical Problem-Solving Abilities on Three Variable Linear Equation Systems based on *Self-Directed Learning* ".

METHOD

The approach used in this research is qualitative, with descriptive data, the data collected is in the form of words or images, so there is no emphasis on numbers. Qualitative data can be obtained using different data collection techniques: interviews, observation, documentation and focused discussions.

In this research, researchers conducted research at As - Suhuf High School, Pamekasan, students of class The subjects in this research were 3 students, the research subjects were taken based on the results of the *self-directed learning questionnaire instrument* which ultimately resulted in high, medium and low levels of *self-directed learning.*

Self-directed learning questionnaire consisting of 30 statement items used in selecting research subjects. The scale measurements in the *self-directed learning questionnaire* can be seen in table 1.

Table 1. *Self-Directed Learning* Questionnaire Scale

Scale	Points	
	Positive	**Negative**
Strongly agree	4	1
Agree	3	2
Don't agree	2	3
Strongly Disagree	1	4

The range of scores used for the level of *self-directed learning* from the results of the *self-directed learning questionnaire* can be seen in table 2.

Table 2. *Self-Directed Learning* Assessment Categories

Value Score	Category
90-120	Tall
60-89	Currently
30-59	Low

The subjects in this research are as shown in table 3.

Table 3. List of Research Subjects

Level of *Self-Directed Learning*	Subject Code
Tall	FI
Currently	NH
Low	FDY

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The collection techniques in this research are the Problem-Solving Ability Test (TKPM) and interviews. Next, data triangulation was carried out which was then used for data analysis. Data analysis in this research is reduction, data presentation, and conclusion.

RESULTS AND DISCUSSION

Analysis of students' mathematical problem-solving abilities is adjusted to the IDEAL stages, namely *I-Identify problem, D-Define goal, E-Explore possible strategies, A-anticipate outcomes and act, L-look back and learn.*

1. Mathematical Problem-Solving Ability of Students with High *Self-Directed Learning Ability*

Through tests and interviews, it was found that the subject was able to fulfill the five problem-solving indicators according to IDEAL. The first indicator is problem identification (*Identify problem*), in this indicator, the subject can identify the problem by writing down what he is asked about from the question completely and precisely, as evidenced by the results of the interview test where the subject can write down every known statement from the question given. The second indicator is determining the goal of the problem (*Define goal*), in this indicator the subject is able to determine the goal or what is asked about the question correctly, as evidenced by the results of tests and interviews with the subject.

The third indicator is searching for and choosing possible strategies (e*xplore possible strategies*), in this indicator the subject can choose strategies that might be used in solving the problem, as evidenced by the results of tests and interviews that have been conducted that the subject stated that he used a combined method to solve the problem. The fourth indicator is implementing the strategy (*Anticipate outcomes and act)*, in this indicator the subject can carry out the chosen strategy to solve the problem correctly, as evidenced by the results of tests and interviews where the subject can explain the results of the work that has been done correctly. Then the fifth indicator is looking back and evaluating the results of their work (*Look back and learn),* in this indicator the subject evaluates the operations and concepts used in solving the problem, as evidenced by the results of tests and interviews conducted stating that the subject can conclude the solution. the question and stated that he had corrected the operations and concepts that had been carried out.

Based on the discussion above, students who have mathematical problem-solving abilities with a high level of *self-directed learning* fulfill the five problem-solving indicators of the IDEAL stage, *identify problems,*

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define goals, Explore possible strategies, Anticipate outcomes and act, and *Look back and learn.*

Figure 1. Subject answers High *Self-Directed Learning Ability*

2. Mathematical Problem-Solving Ability of Students with Medium Level *Self-Directed Learning Ability*

Through tests and interviews it was found that the subject was able to fulfill the three problem-solving indicators according to IDEAL. The first indicator is the identification of the problem, in this indicator, the subject can identify the problem, namely being able to write down what is known from the problem correctly, proven by the results of tests and interviews conducted by the subject. The second indicator is determining the goal of the problem (Define *goal*), in this indicator the subject is able to determine the goal of the problem, namely being able to determine what is being asked or what will be sought from the problem, proven by the results of tests and interviews that have been carried out.

Then the third indicator is searching for and selecting possible strategies (Explore *possible strategies*), in this indicator the subject is only able to example and model what is known from the problem, but the subject is not yet able to provide a statement regarding the strategy that

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will be used to solve the problem. proven by the results of tests and interviews conducted by the subject.

Based on the discussion above, students who have mathematical problem-solving abilities with a moderate level of *self-directed learning* can fulfill the three problem-solving indicators according to IDEAL, namely at the *identified problem, define the goal, explore possible strategies stages,* while the other indicators do not meet.

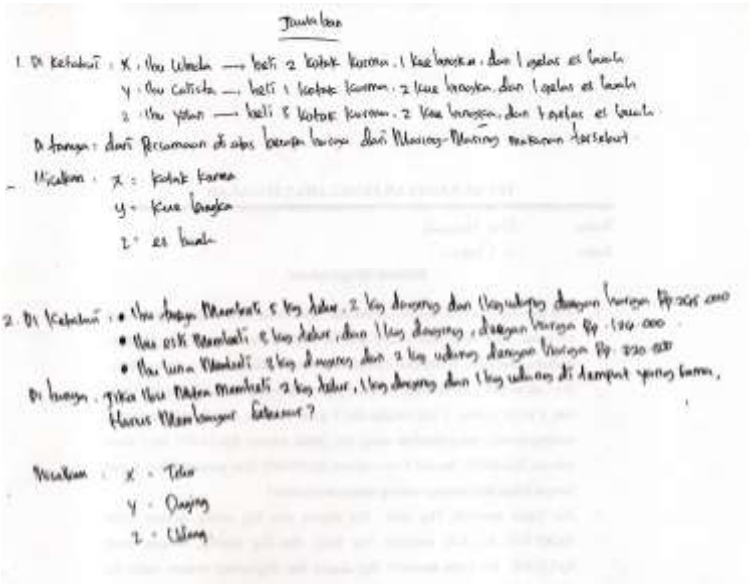

Figure 2. Subject's answer: Medium *Self-Directed Learning Ability*

3. Mathematical Problem-Solving Ability of Students with Low *Self-Directed Learning Ability*

Through tests and interviews, it was found that the subject only met the second indicator of problem solving according to IDEAL. The second indicator is determining the goal of the problem (*Define goal*), in this indicator the subject is able to determine the goal of the problem, namely determining what is asked about the question, as evidenced by the results of tests and interviews. The subject states that usually the question is at the end of the sentence.

Based on the discussion above, students who have mathematical problem-solving abilities with a low level of *self-directed learning* are only able to fulfill the second indicator of problem-solving according to IDEAL, namely being able to fulfill the *defined goal indicator,* and the other IDEAL indicators do not fulfill it.

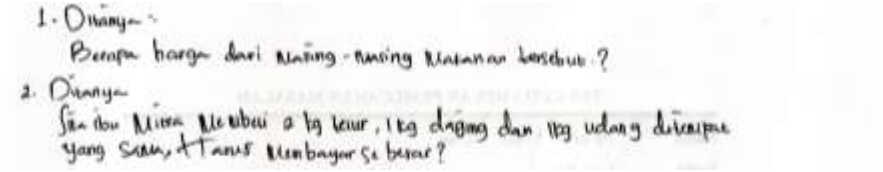

Figure 3. Answers of subjects with low *self-directed learning ability*

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In general, the results of research on students' mathematical problem-solving abilities are based on solving the IDEAL stages in table 4

Table 4. Results of Analysis of Students' Mathematical Problem-Solving Ability

Indicator	*Self-Directed Learning*		
	Tall	**Currently**	**Low**
1	Able to identify problems	Able to identify problems	Unable to identify the problem
2	Able to determine the goal of the problem	Able to determine the goal of the problem	Able to determine the goal of the problem
3	Able to search for and choose possible strategies	Able to search for and choose possible strategies	Not able to search for and choose possible strategies
4	Able to implement strategy	Unable to implement strategy	Unable to implement strategy
5	Able to look back and evaluate the results of his work	Unable to look back and evaluate the results of his work	Unable to look back and evaluate the results of his work

Based on the discussion above, students who have mathematical problem-solving abilities with a high level of *self-directed learning* fulfill the five problem-solving indicators of the IDEAL stage, *identify problems, define goals, explore possible strategies, anticipate outcomes and act,* and *look back and learn*. Students who can solve mathematical problems at the level of *self-directed learning* are at the *identified problem, define the goal, and explore possible strategies stages,* while other indicators do not meet. Students who have mathematical problem-solving abilities with a low level of *self-directed learning can fulfill the defined goal indicator* and other IDEAL indicators do not fulfill it.

This condition is the same with the results of research conducted by Agustina Lubis et al (2023) and Millah (2021) that students who have mathematical problem-solving abilities with a high level of *self-directed learning* can fulfill the four indicators according to Polya, students who have mathematical problem-solving abilities with a moderate level of *self-directed learning* can fulfill the first and third indicators according to Polya, while students who have mathematical problem-solving abilities with a low level of *self-directed learning* are not able to fulfill the four indicators of problem-solving according to Polya

Research conducted by Lailiyyah et al (2023) shows that not all students with *high levels of self-directed learning* can fulfill the four indicators of problem-solving. Students with a moderate level of *self-directed learning* are only able to fulfill indicators 2 and 3, while those with a low level of *self-directed learning* are not able to fulfill all the existing indicators. This research is also supported by research which states that *self-directed learning, self-confidence,* and mathematical disposition have a positive influence on problem-solving abilities (Widodo et al. 2022).

CONCLUSIONS AND RECOMMENDATIONS

Based on the discussion above, the research conclusion is that students who have mathematical problem-solving abilities with a high level of *self-directed learning* have achieved all the problem-solving indicators according to IDEAL. Students with mathematical problem-solving abilities with a moderate level of *self-directed learning* can achieve the indicators of Identifying problems, Determining the goal of the problem (Define *goal)*, and searching for and selecting possible strategies (*Explore possible strategies*) for problem-solving according to IDEAL. Students who have mathematical problem-solving abilities with a low level of *self-directed learning* only achieve the second indicator of problem-solving according to IDEAL, namely Determining the goal of the problem (Define *goal*), in this indicator, the subject can determine the goal of the problem, namely determining what is asked about the problem.

The following are suggestions for future research, including for students, if they are more active in working on practice questions even though the teacher does not give assignments, focus more on working on questions that can improve problem-solving abilities. For teachers, during learning, they should provide practice questions more often, especially questions that can improve problem-solving abilities and provide trigger questions so that students can think independently, and students can improve their independent learning abilities.

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