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Mathematical Problem-Solving Ability in terms of Learning Independence in Problem Based Learning with E-scaffolding.

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Abstract

This study aims to describe the ability to solve mathematical problems in terms of independent learning of students in learning Problem Based Learning with e-scaffolding. The method used in this study was a qualitative method with 36 research subjects in class X IPS 5 at SMA Negeri 1 Lasem in the 2021/2022 academic year. Retrieval of data using independent learning questionnaires, test problem solving abilities and interviews. Data were analyzed descriptively through data reduction, data display, and triangulation. The results of the study show that (1) students with high learning independence have high and moderate mathematical problem-solving abilities; (2) students with moderate learning independence have high, medium, and low problem-solving abilities; (3) students with low learning independence have moderate and low mathematical problem-solving abilities.

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INTRODUCTION

Students with low problem-solving ability are also found in studies where they receive traditional instruction (Mawaddah & Anisah, 2015; Ristiani, 2014). Other studies, however, claim that there is no difference in problem solving skills between students who receive innovative learning and those who receive conventional learning, and that students' problem solving skills remain relatively low (Lestari & Sofyan, 2014). Problem solving ability is the process of solving math problems using one's understanding, skills, and prerequisite knowledge. In schools, math problems are typically presented in the form of story problems (Putri, 2018). There are many students who make mistakes when working on problems using Polya's problem solving instructions, so habituation to working on problem solving problems is required (Putra & Putri, 2018; Rohmah & Sutiarso, 2017).

Teachers play an important role in education because education is about developing students' character as well as transferring knowledge. A strong character will develop a strong mentality, allowing the Indonesian nation to advance and become dignified (Darman, 2017; Manullang, 2013). One of the characters mentioned in Presidential Regulation No. 87/2017 is gaining independence. The improvement of problem-solving ability is supported by classroom learning and student learning independence. As a result, researchers experiment with a suitable learning model, namely Problem Based Learning (PBL), because the steps in PBL aid in the improvement of students' mathematical problem solving. Because of the Covid-19 pandemic, which began on March 16, 2020, all learning at SMA Negeri 1 Lasem is done online (SE Sesmendikbud).

It should be noted that when designing technology-based learning, several factors, including scaffolding, must be considered to support students learning independence (Van Laer & Elen, 2017). Scaffolding based on the concept of e-learning is also known as e-scaffolding. E-scaffolding is online assistance for students (Setiawan et al., 2018). Problem-based learning with e-scaffolding can describe students problem-solving abilities. This mathematical problem-solving ability must be described in terms of student independence, whether the results of the mathematical problem-solving ability test are truly representative of students learning independence.

The goal of this research was to describe mathematical problem-solving skills in terms of students' learning independence in Problem Based Learning with e-scaffolding.

METHOD

The study was carried out in a qualitative manner. The research subjects were 36 students from class X IPS 5 SMA Negeri 1 Lasem in the 2021/2022 academic year. A questionnaire method of learning independence, mathematical problem-solving ability tests, and interviews were used to collect data. Data reduction, data display, triangulation, and conclusion drawing were used to analyze the data.

RESULTS AND DISCUSSIONS

Table 1 shows the results of determining students' learning independence categories.

Tabel 1 Determination of Learning Independence Categories

Learning Independence Categories	Score	Number of Students	Percentage
Low	Score $<$ 56,68	7	19%
Moderate	56,68 $\leq$ Score $<$ 93,19	20	56%
High	Score $\geq$ 93,19	9	25%

Based on the acquisition of these data, 7 students have low learning independence, 20 students have moderate learning independence, and 9 students have high learning independence. Furthermore, the treatment was given in the form of Problem Based Learning with e-scaffolding through schoology with a math problem solving ability test at the last meeting.

On Friday, October 29, 2021, 36 students participated in a posttest of problem-solving ability. Students' posttest responses to problem solving ability were collected using a Google form link distributed to

them. The results were then analyzed using NCTM (2003) problem solving ability indicators, which are as follows: (1) Apply and adapt various approaches and strategies to solve problems, (2) Solve problems that arise in mathematics or other contexts involving mathematics, (3) Build new mathematical knowledge through problem solving, and (4) Monitor and reflect on the mathematical problem solving process (Murwati, 2017). Table 4.2 shows the grouping of posttest results for mathematical problem-solving ability.

Tabel 2 Grouping of Mathematical Problem-Solving Ability

Problem Solving Ability Categories	Indicators	Number of Students	Percentage
Low	Meets ≤ 1 Indicator	6	17%
Moderate	Meets ≥ 2 Indicator	22	61%
High	Meets 4 Indicator	8	22%

Based on these findings, there are 8 students with high mathematical problem-solving ability, 22 students with moderate mathematical problem-solving ability, and 6 students with low mathematical problem-solving ability. Interviews were conducted to confirm students' learning independence by analyzing the results of mathematical problem-solving abilities in seven subjects with codes S1 to S7 chosen using learning independence criteria, namely two students with high independence, three students with moderate independence, and two students with low independence. The following is a description of students' learning independence in terms of their ability to solve math problems.

Mathematical Problem-Solving Ability with High Learning Independence

There are 9 students with high learning independence, with 5 having high mathematical problem-solving abilities and 4 having moderate problem-solving abilities. The following is an example of the problem-solving test results for students in the high learning independence category.

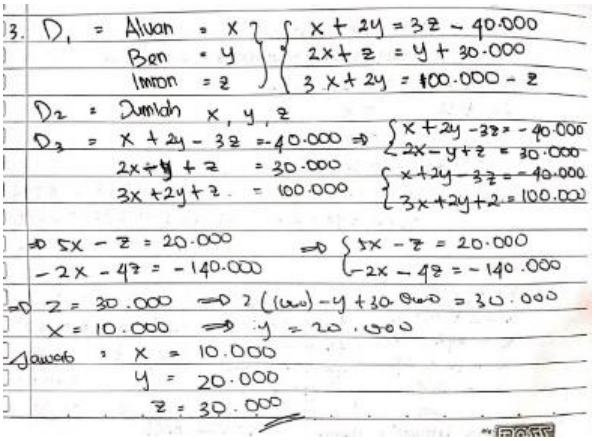

Figure 1 Test Results of High Learning Independence Category Students

Mathematical Problem-Solving Ability with Moderate Learning Independence

There are 20 students with moderate learning independence, with two students having low mathematical problem-solving ability, 15 students having moderate mathematical problem solving ability, and three students having high problem solving ability. The following is an example of a mathematical problem-solving ability test test results for students in the moderate learning independence category.

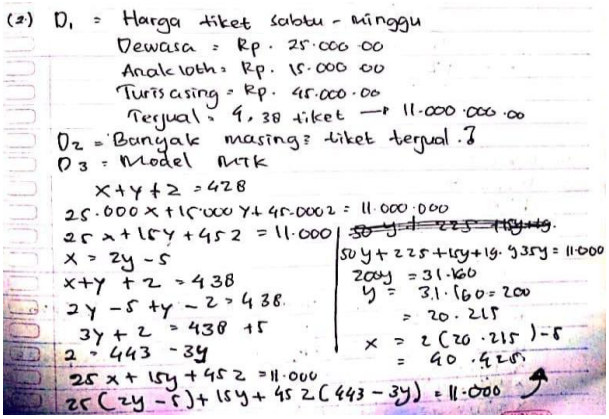

Figure 2 Test Result of Moderate Learning Independence Category Students

Mathematical Problem-Solving Ability with Low Learning Independence

There are 7 students with low learning independence, with 4 having low mathematical problem-solving ability and 3 having moderate problem-solving ability. The following is an example of a mathematical problem-solving ability test results

for students in the low learning independence category.

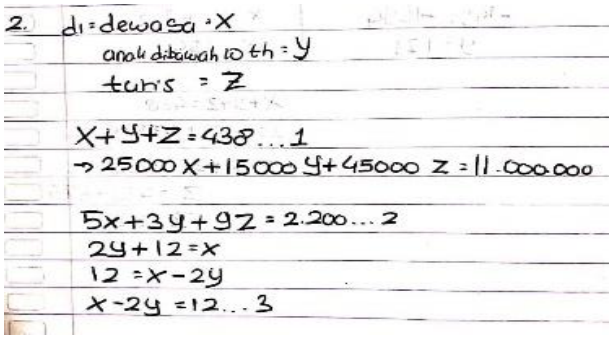

Figure 3 Test Result of Low Learning Independence Category Students

In this study, students engage in online learning by completing assignments via a Google form link provided by the teacher. Students demonstrated an active and enthusiastic attitude during the learning process. This is demonstrated by the large number of students who respond while learning. The teacher divides groups to work on LKPD during learning by grouping students heterogeneously based on their initial abilities. Students are more likely to actively inquire about the problems presented, but they lack confidence when asked to explain the results of their group's work because they are too embarrassed to answer incorrectly. Because the problems are story problems, the solutions and methods used by different groups may differ.

Providing Problem Based Learning with e-scaffolding occurs during learning by assisting students in solving problems based on mathematical problem-solving ability indicators. During LKPD work and individually via private chat. When providing e-scaffolding to students who are less enthusiastic about learning, the problem is that they will ignore or disregard the assistance provided. In contrast to eager students, they will inquire about and comment on the assistance provided. This is consistent with the findings of other studies, which show that e-scaffolding in online learning can help students achieve higher levels of learning achievement (Al Mulhim & Zaky, 2022; Amelia et al., 2020; Amelia, 2021; Sarah, 2022).

This condition differs from that of students who received PBL without e-scaffolding. Students were less active in asking questions during learning, only doing what was asked, and only a few students responded during learning. This is consistent with the findings of other studies, which indicate that scaffolding is required to maximize student learning outcomes. Furthermore, the use of PBL can be used to determine the interaction between students during discussions in problem solving (Y. J. Lee, 2017; Rahmantiwi & Rosnawati, 2018; Meke et al., 2019).

Students who have a high level of learning independence are more active in asking questions, both through whatsapp private chat and during schoology learning. Even when students are learning and having difficulty understanding what they are learning, they do not hesitate to ask questions, even after class. Students with moderate learning independence tend to work with the teacher's resources. The same is true for students who lack learning independence. Students with low learning independence do not appear to be interested in looking for solutions to problems. They only do what they understand, regardless of whether the outcome is correct or incorrect. This is consistent with the findings of several research studies, which show that learning independence improves student achievement. Errors in problem solving occur because students do not fully understand the problem, are less precise in modeling mathematics, and make mistakes while working on the problems provided (Lutvaidah & Hidayat, 2019; Sari & Aripin, 2018; Handayani Z, 2017; Sundayana, 2018; Rohmah & Sutiarso, 2017).

CONCLUSION

1. Students with high learning independence have high and moderate mathematical problem solving abilites.
2. Students with moderate learning independence have high, moderate, and low mathematical problem-solving abilities.
3. Students with low learning independence have moderate and low mathematical problem-solving abilities.

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