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Analysis of Students' Mathematical Problem Solving Ability Based on Polya's Procedure on the System of Linear Equations With Two Variables

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Abstract

This study aims to analyze the mathematical problem solving ability of eighth grade students at MTs al-Munawarah using the Polya procedure on the material of two-variable linear equation systems. Data collected through problem solving ability tests and interviews. Indicators of problem solving ability based on Polya include; understanding the problem, planning problem solving, implementing the solution and rechecking. This research method uses a descriptive qualitative approach. The data analysis used is descriptive statistics. The results of the analysis show that subjects with high ability are able to fulfill the Polya procedure indicators well and show significant improvement. Furthermore, subjects with moderate ability are only able to fulfill three indicators in the Polya procedure, namely the fourth indicator is rechecking the subject does not recheck the answers that have been completed. While low ability subjects can only fulfill one indicator, namely the subject is able to understand the problem in the question, but low ability subjects still have difficulty in compiling and implementing problem solving and do not recheck the answers

Keywords *:* Mathematical Problem Solving Ability, Problem Solving Steps, SPLDV Questions.

Introduction

Education is a key element in a person's life, helping to facilitate various activities through the learning process both at school and at home (August & Ramlah, 2021). Education not only plays a role in building the nation's generation but also encourages innovation in learning methods. One of the subjects that has an important role is mathematics, which is considered the basic science of all knowledge (Angga Firmansyah, 2011). Mathematics is universal and contributes to solving various daily problems, such as calculating, measuring, and managing resources (Nisa & Bustoniyah, 2015) .

Mathematics has been recognized as a major subject from elementary school to college because of its relevance in various fields of science and life (Rizkiyah, 2018). According to the national education system law number 20 of 2003, mathematics must be taught in schools because it plays a role in developing human thought patterns. The importance of mathematics is also reflected in religious teachings, such as in QS Al-Jin verse 28, which emphasizes how calculations and management of knowledge are carried out in depth (Akbar, 2017).

Problem-solving ability is the main goal in mathematics learning (Darmasrura Suharni, 2021). The Polya procedure, which includes the steps of understanding the problem, planning a strategy, implementing the solution, and evaluating the results, provides a systematic framework for students to develop this ability (Nurdin et al., 2020). However, TIMSS and PISA survey data in 2021 show that students' mathematical problem-solving abilities in Indonesia are still low. This is due to students' lack of understanding of the material and

limitations in converting story problems into mathematical equations (Susanti, 2017).

Based on observations at MTs Al-Munawwarah, Jambi City, many students face difficulties in solving SPLDV problems due to low mastery of the material and limited teaching time available. Teachers also revealed that learning methods and students' interest in mathematics are significant factors in problem-solving abilities (Mawaddah, 2015). Therefore, this study aims to analyze the mathematical problem-solving abilities of grade VIII students on SPLDV material using the Polya procedure to provide more effective solutions and learning strategies (Arjuna & Lisa, 2020).

Methods

1. Place and Time of Research

The place or location of this research is at MTs Al-Munawarah, Jambi City, this research was conducted from June 5 to July 15, 2024, even semester of the 2023/2024 academic year.

2. Data Types and Sources

The research that has been conducted uses a descriptive qualitative approach. Where in qualitative research, Participatory Observation, unstructured interviews and documentation are used. The scope of this study examines "How is the description of students' mathematical problem solving abilities in solving SPLDV problems, in class VIII students at Mtss Al-Munawarah, Jambi City.

The subject of this study is purposive sampling, which can select samples with certain criteria (Sugiono, 2015). The sampling that will be used in qualitative research is to filter as much information as possible that has been obtained from various sources.

Study This Which will become subject study that is student Class VIII of Mts Al-Munawarah, Jambi City, taken from one class with a total of 30 student. So each student given test question story a system of linear equations of two variables in order to find out the extent of students' abilities

3. Research Instruments

a. Observation

Participatory observation is a research method in which researchers are directly involved in the social life or community being studied. In this approach, researchers not only observe, but also interact and participate in the daily activities of research subjects. The goal is to gain a deeper understanding of behavior, culture, and social dynamics in their natural context (Sugiono, 2018). The observations made in this study were observing students when working on descriptive questions, with the material of a two-variable linear equation system seen based on indicators of mathematical problem-solving ability. Researchers pay attention to and observe the process of working on questions carried out by students, but researchers are not directly involved in what students are doing.

b. Interview

The interview technique used in this study is an unstructured interview. An unstructured interview is a free interview where the researcher does not use interview guidelines that have been systematically and completely arranged for data collection. The interview guidelines used are only in the form of outlines of the problems to be asked, such as after students have completed a test in the form of SPLDV

questions (Sugiono, 2018). The researcher will select 6 students to be interviewed with details of 2 students representing the high-ability group, 2 people representing the medium-ability group, and 2 people representing the low-ability group. The purpose of this interview is to explore the answers given by students. In this process, researchers can explore information related to student abilities by asking several questions that are adjusted to several existing indicators.

c. Documentation

Documentation techniques in this study are used to examine, assess, review and interpret information obtained from observations and interviews conducted. Documentation techniques can help researchers gain a deep understanding of the context and background of the problem being studied. For example, obtaining data in the form of archives, notes, books and written test results conducted by class VIII students of MTs Al-Munawarah, Jambi City.

4. Data analysis

Analysis is an attempt to break down a problem into parts so that the composition is formed into something that is clearly broken down so that the problem can be understood. Data analysis is searching for and systematically arranging data that will be obtained through interview results, field notes and other materials by organizing data into categories, describing them into units, arranging them into patterns, choosing which ones are important and making conclusions for themselves so that they are easy to understand. In this study, the data analysis technique used is descriptive statistical analysis. According to (Sugiono 2015), descriptive statistics are statistics used to analyze data using a method, namely describing the data that has been collected. In this study, the descriptive statistics referred to are qualitative descriptive statistics where researchers will describe students' problem-solving abilities in solving mathematical problems about two-variable linear equation systems.

Results and Discussion

The facts that have been obtained in this study, then this study is to analyze the collected data, for this data analysis the researcher uses descriptive qualitative analysis, where in data collection using data triangulation techniques, namely: Observation of mathematical problem solving abilities, interviews, and documentation.

The results of tests and interviews conducted by researchers with 6 subjects, with each subject taken 2 for each level of mathematical problem solving ability. The following are the results of the analysis of problem solving abilities in high-ability, medium-ability, and low-ability subjects in solving SPLDV problems.

a. **Understanding the Problem**

The results of the test and interview are that students with high abilities are able to understand the problem, namely students can describe the problem in the question. According to researchers (Febriyanti et al., 2022) students are able to understand the problem if the student can state what is known, and is asked using simple words, or described in mathematical form.

Furthermore, students with moderate abilities are able to understand the problems in the questions by identifying the problems so as to obtain results. According to researchers (Hendraman, 2021) Subjects with moderate abilities can understand

problems very well, Subjects are able to identify what is known and what is asked to solve problems.

The results of the test and interviews of low-ability students showed that students were able to write down what was known and what was asked in the questions to solve the problem. Similarly, research (Marliani, 2020) explained that subjects were able to identify what was known and what was asked to solve the problem.

b. **Compiling a Solution**

The second indicator is compiling solutions for high-ability students, able to change questions that were originally sentences or stories into mathematical models. Similarly, research (Febriyanti et al., 2022) stated that for the second indicator, subjects were able to find concepts related to the questions and find the formulas needed.

Furthermore, students with moderate abilities can write mathematical models well, but in question number 5, some subjects make problem-solving plans that do not match the stages in the question. Based on the Researcher (Nurul, 2020), the problem-solving ability of Subjects with moderate abilities can explain the relationship between what is known and what is asked in the question correctly, but the creation of mathematical models is not very detailed.

Students with low abilities have not been able to explain the relationship between known and asked in the question correctly, also make mathematical models in the question less precise, and the Subject has not been said to be able to formulate a problem-solving plan. Based on research (Hermawati et al., 2021) revealed that in planning problem solving the Subject is said to be sufficient, but the subject cannot identify the relationship between known and asked in the question accurately.

c. **Implementing the Problem Solving Plan**

The next indicator is implementing a high-ability student's solution plan, which can create a systematization of questions such as; eliminating one of the variables, then substituting to obtain the correct results. According to researchers (Febriyanti et al., 2022), in this indicator, the Subject must create a systematization of the questions in standard form, which means that the Subject creates the formula needed to solve the questions.

Students with moderate abilities are able to eliminate known equations and substitute values into mathematical models so that they can solve the problem calculations correctly. The subject carries out the calculation process but there are steps that have not been completed. The researcher (Meidina, 2019) also said that if the subject writes the answer at the stage of implementing the plan, and is able to describe the solution even though the steps used are not quite right.

Furthermore, low-ability students for numbers 3,4 and 5 did not use the elimination method, substitution method, and mixed method. These methods were not used by the subjects in working on the questions. At this stage, the researcher did not find the solution process, and did not provide an answer. Research (Lestari, 2020) said that the Subject was not yet able to compile with inappropriate steps, because he had not completed the previous steps.

d. **Double Checking Answers**

The last indicator is re-examining high-ability students can reconsider the

answer by adjusting the results with what is asked in the question, then developing the results by drawing conclusions on the answer sheet. Based on the Researcher (Juniati et al., 2020) revealed that students can reconsider their responses by using the known components in the question.

Students with moderate abilities recheck but are incomplete, as can be seen from how some subjects do not write conclusions on the answer sheet. Based on the results of the study (Hermawati et al., 2021), the subjects rechecked but were incomplete, in this case the subjects wrote conclusions but could not prove the results obtained.

Furthermore, low-ability students do not write conclusions, do not recheck the answers, and the answers given are only guesses. Furthermore, based on research (Aisyah, 2021) Subjects were unable to check all calculations on the answer sheet and did not write conclusions. So that low-ability subjects are only able to meet the indicators of understanding the problem and planning the problem, but for the indicator of implementing the plan, the Subject still lacks mastery, and has not been able to recheck the answers.

Conclusion

This study aims to Analyze Students' Mathematical Problem Solving Ability Using the Polya Procedure on the Material of Two-Variable Linear Equation Systems (SPLDV). Based on data collected through Observation of Problem Solving Ability and Interviews with Students. The results of the study showed that Subjects with high ability were able to fulfill the Polya procedure indicators well, showing a significant increase. Furthermore, Subjects with medium ability were only able to fulfill three indicators in the Polya procedure, in the fourth indicator, namely re-checking, the Subject did not re-check the answers that had been completed. While Subjects with low ability could only fulfill one indicator, namely the Subject was able to understand the problems in the questions, but Subjects with low ability still had difficulty in compiling and implementing problem solving and did not re-check the answers.

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