ANALYSIS OF MATHEMATICAL PROBLEM-SOLVING SKILLS SPLDV MATERIAL BASED ON STORY QUESTIONS REVIEWED FROM UNDERSTANDING THE CONCEPT

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Abstract

This study aims to analyze the types of error abilities of grade VIIID students of Widya Wakti Junior High School, Denpasar, in solving problem-solving story problems in SPLDV material based on concept understanding with Newman procedures. This research method is a qualitative descriptive research. Data collection was carried out using written tests and interview methods. The research subjects were taken from 30 students in grade VIIID of Widya Sakti Junior High School, Denpasar. Each work result of the research subject was analyzed to describe the types of errors using the Newman analysis method, and then interviews were conducted to describe the students' errors. Based on the results of the study, it can be concluded that the types of errors that arise when students solve SPLDV questions are 1) Mistakes in understanding the questions, which include not writing down what is known in the questions, and not writing down the things asked in the questions. 2) Transformation errors that include not understanding the solution method used. 3) process capability errors, which include not completing the process. 4) Final Answer Writing Errors, which include not writing the final answer in the question. The factors that cause student errors are students who are not careful in doing problems, students who are too hasty, and students who do not practice story problems.

Keywords: Ability Analysis, Understanding the Concept, SPLDV Story Questions

Abstrak

Penelitian ini bertujuan menganalisis jenis kemampuan kesalahan siswa kelas VIIID SMP Widya Wakti Denpasar dalam menyelesaikan soal cerita pemecahan masalah pada materi SPLDV berdasarkan pemahanan konsep dengan prosedur Newman. Metode penelitian ini merupakan penelitian deskriptif kualitatif. Pengumpulan data dilakukan dengan menggunakan metode tes tertulis dan wawancara. Subjek penelitian diambil 3 orang siswa dari 30 siswa kelas VIIID SMP widya sakti denpasar. Setiap hasil pekerjaan subjek penelitian dianalisis untuk mendeskripsikan jenis-jenis kesalahan menggunakan metode analisis Newman kemudian dilakukan wawancara untuk mendeskripsikan kesalahan siswa. Berdasarkan hasil penelitian dapat disimpulkan bahwa jenis kemampuan kesalahan yang muncul saat siswa menyelesaikan soal SPLDV adalah 1) Kesalahan memahami soal, yang meliputi tidak menuliskan hal yang diketahui dalam soal dan tidak menuliskan hal yang ditanyakan dalam soal. 2) kesalahan transformasi yang meliputi tidak paham dengan metode penyelesaian yang digunakan. 3) kesalahan kemampuan proses yang meliputi tidak melanjutkan proses penyelesaian. 4) kesalahan penulisan jawaban akhir yang meliputi tidak menuliskan penulisan jawaban akhir dalam

soal. Faktor-faktor dari penyebab kesalahan siswa adalah siswa kurang teliti dalam mengerjakan soal, siswa terlalu terburu-buru, siswa kurang berlatih soal-soal cerita.
Kata kunci*: Analisis Kemampuan, Pemahanan Konsep, Soal Cerita SPLDV*

INTRODUCTION

21st century education, where students are required to be able to develop their potential by paying attention to affective, psychomotor, and cognitive aspects. With these three aspects of assessment, students can improve their ability to become knowledgeable, insightful, independent, capable, disciplined, and responsible for something. This is in line with the goals of National education as stated in Law of the Republic of Indonesia No. 20 of 2003, Article 1. The education obtained by students includes a variety of subjects, of which one of the subjects that can develop students' ability to solve problems is mathematics.

According to Umaroh & Pujiastuti, (2020) Mathematics is the queen of sciences, which is used as a source of other disciplines. There are many branches of science whose theory development is based on mathematical concepts. So, mathematics is very important to be mastered and understood by every student. By studying mathematics, students will be trained in their thinking skills so that they can logically and systematically solve various problems related to mathematics and daily life (Ulva & Amalia, 2020). Understanding concepts is an important factor in learning activities (Tama, 2020). Conceptual comprehension has a close relationship with students' interest in learning and problem-solving (Suliarso et al., 2021; Sumadi et al., 2023). Students in elementary school need a proper understanding of concepts in each lesson. NCTM states that understanding concepts is the basic goal of learning mathematics (Sari et al., 2020). When students already understand the concept of mathematics, they will easily solve problems in mathematics lessons. The same thing was expressed Saraswati & Hidayat, (2019), who stated that mathematics is a hierarchical subject where the knowledge of a topic is a continuation of the previous topic, so that students must be able to understand new knowledge by having pieces of information about previous knowledge. Mathematics is a knowledge in which the understanding of a concept is built cumulatively (Saraswati & Hidayat, 2019).

One of the problems that often arises in mathematics learning is the low ability of students to solve mathematical problems in the form of problems that place more emphasis on understanding concepts in a certain subject. Students who have understood the NSEP well in the learning process are more likely to have high learning achievement because it is easier to follow learning, while students who do not understand concepts tend to have more difficulty following learning (Bagus, 2018). Students' low ability in terms of concept understanding is an important thing that must be followed up on. Regarding the importance of understanding mathematical concepts, the researcher conducted observations, interviews, and looked at the documentation of exercises and the results of students' tests in the previous material. Based on the results of an interview with mathematics at Widya Sakti Junior High School Denpasar in November 2024, the reality

was obtained that the understanding of mathematical concepts of grade VIII students is not so good, which can be seen from the symptoms: Students cannot solve problems that are different from the examples, students only memorize formulas but do not know their meaning, students forget about the material that has been studied even though the material is related, and students have not been able to apply the concept of the lesson into their lives.

The Newman method is a stage to master and analyze how students solve mathematical problems through 5 stages in solving mathematical problems, namely reading, mastering problems (comprehension), changing problems (transformation), process skills, and writing final answers (encoding). These differences include intellectual, reasoning, inventiveness, cognitive style, character, numbers, actions, and attention. Researchers in the world are interested in studying the relationship between cognitive style and mathematical problem-solving ability Cognitive style is a bridge between a person's intelligence and personality The focus of research from previous research generally lies in the view of achievement results and mathematical learning outcomes, but it has not specifically studied one of the special abilities in mathematics, namely problem-solving skills. In this regard, the purpose of this study is to describe the analysis of the mathematical problem-solving ability of SPLDV material based on story problems reviewed from the understanding of concepts.

METHOD

The method used in this study is a descriptive method with qualitative data (Budianto, 2024). The purpose of this study is to describe the mathematical problem-solving ability of students of Widya Sakti Junior High School, Denpasar, on the material of the two-variable linear equation system. The subject in this study is 30 students from class VIII D of Widya Sakti Junior High School Denpasar, with 3 students at high, medium, and low levels of mathematical concept understanding skills. So the technique of collecting a sample of 3 students uses the purposive sampling technique. Purposive sampling technique is a sample determination technique that is based on the researcher's consideration of which samples are most suitable, useful, and considered to be representative of a population (representative). This sampling technique tends to be higher in sample quality. Because the researcher has made a grid or boundary based on certain criteria that will be used as a research sample. For example, it is based on demographic characteristics, gender, type of work, age, and so on. The test instruments given to students are in the form of description questions, with the number of questions, each question contains the criteria of SPLDV story questions (C3), applying (C4), analyzing (C5) evaluating. Furthermore, the instrument of this test question has been validated by one mathematics teacher from Widya Sakti Junior High School, Denpasar 2 experts from the Mathematics Education University of Ganesha Education, with the results of validation that the instrument is valid. The technique of collecting data, reducing data, and analyzing data to conclude.

Table 1. Indicators of Problem-Solving Ability According to Newman

NO.	TROUBLESHOOTING STEPS	INDICATOR
1.	Reading	The ability to read questions (reading) requires students must be able to: Read/Recognize the symbols in the questions; Understand the meaning of the symbols in the question; Interpret the keywords contained in the question.
2.	Memahami (Comprehension)	To comprehend students, students must be able to: 1. Understand the overall meaning of the question;
		2. Write down and explain what is known about the problem.
		3. Write down and explain what is asked in the question.
3.	Transformasi (Transformation)	1. Using the formula/method used to solve the problem;
		2. Identify mathematical operations/array operations to solve problems in the problem appropriately.
		3. Identifies an operation, or a series of operations.
4.	Process skills	1. Knowing the way or algorithm to solve the problem, even though it can determine the formula/method correctly;
		2. Perform the procedure correctly, even though it can determine whether the mathematical operations are used correctly.
5.	Final answer writing (encoding)	1. Write down the solution that students intend to use appropriately.
		2. Reveal the problem-solving process for the problems that students are working on in an acceptable written form.
		3. Write the conclusion of the work results appropriately.

RESULT AND DISCUSSION

According to Banerji et al., (2013), the importance of error analysis is that in learning activities, teachers must really analyze students' mistakes, try to understand mistakes, explain what they experience, and find out what caused the mistakes to occur. Depending on the conclusions of the analysis, teachers should choose means of correction and methods to deepen students' understanding of mathematical concepts, improve their

reasoning methods, and refine their skills. To achieve that, teachers need certain knowledge about mistakes and methods of responding to mistakes.

Based on the results of the research, each research subject from the selected high, medium, and low groups was given a mathematical problem-solving ability test, and then an interview was conducted. After that, the results of the test and interview were analyzed for students' ability to solve mathematical problems with the Newman stage thoroughly. The following is a complete explanation of students' ability to solve mathematical problems, based on the understanding of students' concepts

Analyze students' problem-solving skills with concept understanding

1. Analysis of documentation Question number 1

From the results of the work of high group students, it can be seen that the work of students is able to solve the stages in the Newman procedure, seen from understanding the problem, the student is able to solve what is known and asked in the problem, we see that the student is able to solve the problem, but transforming the problem, the student is able to do a mathematical model or do the reasoning of the problem, we see from the work of the student is able to solve the transformation of the problem and The student's process ability has followed the procedure and is able to complete this stage as seen from the results of the student's work where the student's ability to write the final answer is still wrong to conclude the result of the answer where the student only writes the answer without resuming from the results of the work, we see the results of the student's work for writing the final answer that the student has not been able to re-conclude the results of his work seen in the image below.

Interview Analysis

Excerpts of interviews with high group students on question number 1

P: Dik, try to read the question! Do you understand that?"

SS   : (reading the question) I understand the question, sir.

P: Well, from the questions you read. What is the question asked?

SS: who was asked how much 1 kg of mango costs

P: Do you know where your mistake lies, brother?

SS: I see my answer is correct, sir

P: Try to check your answer carefully.

SS: Oh yes, sir, I forgot to write down the final answer, sir, because I was in a hurry to collect the answer, sir

P: It's good if you know your mistakes, dik. Next time, before you get together, remember to check your answer first, dik

SS: Okay, sir. Thanks

Based on the results of interviews with high-group students, data reductions were obtained that students were able to read questions, understand problem transformation problems and process skills correctly, but students forgot to write down the final answer or did not conclude the answer from the results they got because students were in a hurry or a hurry.

## 2.	Analysis of documentation Question number 2

Based on the results of the problem solving test number 2 contained in figure 2, it can be seen that students are able to understand the problem in the stage because the student is able to write what is known and asked in the question where the student is able to complete the stages in the procedure used next in writing the stages of problem transformation where the student is able to complete the part of the stage seen from the results of the student's work is in accordance with the stages of the procedure used that The student is able to complete a stage by reasoning or making a mathematical model in that stage, then for the transformation of the problem, the student is able to substitute a problem judging from the results of the student's work that the student has passed or has passed the stages in accordance with the procedure used, but it can be seen in the writing of the final answer that the student did not write the final answer of the procedure used where students do not conclude the answers obtained from the results of the student's work that where the student is not able to write or conclude the final result.

Interview excerpts with the medium group students in question number 2

P: Dik, try to read the question! Do you understand that?"

SS: (Reading the question) I understand the question, sir.

P: Well, from the questions you read. What is the question, and what is known in the question?

SS: What is the size of the length and width of the rectangle

P: How does DIK transform the problem in this problem?

SS: I do a reasoning or do a mathematical model, for example, the length of the rectangle, i.e., and the width of the rectangle, i.e. $= x\, cm = y\, cm$

P: How do you determine the value of x?

SS: I substitute the press for the press, $, y = x - 6x + y = 12$

P: Good brother!. How do you determine the y-value?

SS: to determine the value of y, I set the result of the x that I got, which is 14, to the press, $y = x - 6$

P: Good brother!. Are the results of your work correct, Dik?

SS: That's right, all sir

P: Would you like to check your answer?

SS: Well, sir, I'll check it out first!

P: How are all the results of your work correct?

SS: Oops! I didn't write the final answer, sir, I didn't conclude it again

P: It's good if you know your mistakes next time before getting together, check the results of your work first, so that you don't make any mistakes in the future.

SS: Good, sir! Thanks

Based on the results of interviews with the students of the group of students, data reductions were obtained that students were able to read problems, understand problems, can do but students are not able to write the final answer because where students do not check the results of their work.

3.   Analysis of documentation Question number 3

From the results of the work of the students of the lower group where the students are able to complete the stages in the procedure, it is seen from understanding the problem, the student is able to solve and has understood the meaning of the problem, what is known and asked, the student has answered correctly judging from the results of the work of the students of the lower group have followed the procedure in working on the problem, able to exemplify the intention of the problem by using a mathematical model, but in

transforming the student's problem unable to complete writing in the form of procedural stages made in mathematics where we see from the results of the student's work that it is indeed lacking in understanding in the process of transforming the problem but in process skills students are less able to determine the value or write what is substituted but the student does it not in accordance with the procedure used for writing the final answer, students are able to conclude the results of their work, we see from the results of their work that students have followed the procedure for writing the final answer, therefore, students are able to conclude the answer.

Excerpts of interviews with low-group students in question number 2

P: Dik, try to read the question! Do you understand that?"

SS   : (reading the question) I understand the question, sir.

P: Well, from the questions you read. What is the question, and what is known in the question?

SS: who were asked how old they were.

P: How did DIK transform that problem?

SS: I don't understand until the stage of transforming the problem, sir. I write everything straight

P: Try to check your answer carefully.

SS: I am still confused about answering in the next stages, sir

P: For writing the final answer, is it correct, Dik?

SS: For writing the answer, I finally understand that, sir, I have done it with Bena.

P: It's good if Next time, before getting together, remember to check your answer first and pay attention to the steps in working on the question

SS: Okay, sir. Thanks

Based on the results of interviews with low-group students, data reductions were obtained that students were able to read questions, understand problems, were able to do them, but students were unable and still confused to do the next stages in transforming problems and process skills, but for the final answer analysis, students were able to write the final answer and had concluded correctly.

Table 2. Ability levels and types of student errors

STUDENT ABILITY LEVEL	SUBJECT	TYPES OF ERRORS FOR EACH QUESTION		
		1	2	3
TALL	9	-	E	E
KEEP	16	E	TP	E
LOW	20	CT	P	TP

Information:

C = Understanding the Problem

T = Problem Transformation

P = Process Skills

E = Final Answer Writing

Based on the recapitulation table of the types of student mistakes made by the research subjects in working on the two-variable linear equation system problem in class VIIID SMP Widya Sakti Denpasar, students' problem-solving skills by working on SPLDV story problems can show that students can work on the problem according to the stages of the Newman procedure.

CONCLUSION

Based on the results of the analysis, discussion, and findings obtained during the research process, it can be concluded that students experienced various types of errors in solving problems related to the system of two-variable linear equations, which were identified based on Newman's Error Analysis framework. The study revealed that students in the medium and low ability groups encountered significant difficulties in understanding the questions. These students were unable to grasp the implicit aspects of the problems and struggled to transform the information provided into mathematical models or expressions. This lack of comprehension was reflected in their inability to determine what was being asked, which directly impacted their problem-solving process. Furthermore, the research indicated that students made errors during the transformation stage, particularly those in the medium and low groups, who often failed to represent the problems appropriately, leading to incorrect or incomplete strategies in solving the equations. Additionally, errors in process skills were commonly observed, especially in calculation procedures. Students were frequently unable to carry out the necessary computations accurately or completely,

often stopping midway without arriving at a conclusive answer. The most frequent error found across all ability groups—including high-performing students—was in the final answer checking phase. Students generally did not verify their answers or include logical reasoning as justification for their solutions. Many of them did not double-check their results, which suggests a lack of reflective habits in their mathematical practice. Based on these findings, it is suggested that students should develop stronger conceptual understanding and not hesitate to seek assistance when facing difficulties. Teachers are encouraged to identify specific types of student errors and provide targeted guidance to help students overcome them. Future researchers are advised to expand this study by applying it to different contexts and subjects to gain broader insights into students' problem-solving errors.

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