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Analysis of the Mathematical Problem-Solving Ability on Two-Variable Linear Equation System Material in Grade VIII Students

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Abstract: This study aims to describe the ability to solve mathematical problems on two-variable linear equation system material based on the locus of control in grade VIII students. This study used qualitative methods to obtain a sample of 72 students using purposive sampling. Data collection techniques use locus of control questionnaire instruments and problem-solving ability test questions. The results of this study showed that students with a strong external locus of control were only able to reach a step of understanding the problem. Meanwhile, students with a balanced internal and external locus of control can reach two steps namely, understanding the problems and devising a strategy. This happens because, students with a strong external locus of control, as well as students with a balanced internal and external locus of control, are less trying and less active in seeking information related to the problems at hand, and are easily influenced by others. Meanwhile, students with a strong internal locus of control can reach three steps namely, understanding the problems, devising a strategy, and carrying out the strategy. This happens because students have a strong internal locus of control easily satisfied with the results they get with the effort they make.

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Introduction

One of the objectives of learning mathematics according to the 2013 curriculum is to be able to solve problems (Rizqullah, Aziz, & Yuyu, 2023). Based on the objectives, one of the competencies expected to be possessed by junior high school students is problem-solving ability. Problem-solving ability is a skill or potential in students to solve problems by applying their knowledge (Turmuzi, Sripatmi, Azmi, & Hikmah, 2018). Facts in the field, especially in grade VII students of SMPN 4 Narmada in the academic year 2022/2023 when given problem-solving questions show that students have not been able to write down the elements known and asked in the questions. Students have not been able to make problem-solving strategies and apply these problem-solving strategies to conclude, so they have not been able to look back at what has been made. Based on this, it can be concluded that students' mathematical problem-solving ability is still low.

According to Polya (1973), there are four steps to solving the problem, namely: (1) understanding the problem; (2) devising a strategy; (3) carrying out the strategy; and (4) looking back (Ain, Baidowi, & Hapipi, 2020). In answering problem-solving, skills are needed to extract information from concepts or knowledge that have been owned and connect

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it with other concepts to solve existing problems (Amrullah, Sari, Azmi, & Sarjana, 2021). Especially in the material of the two-variable linear equation system (SPLDV), students need several problem-solving steps to find solutions to existing problems.

Student success in answering problem-solving problems is not only influenced by cognitive factors that come from internal students but also influenced by external factors such as the influence of others, fate/fate, and luck. Based on observations through interviews with grade VIII mathematics teachers of SMPN 4 Narmada stated that students' mathematical problem-solving skills were in the low category. This happens because many students consider mathematics a difficult subject to learn, so they put less effort into doing the tasks given by the teacher. In addition, not a few of them only rely on answers from peers who are considered to have abilities above them and wish luck. Cognitive, the influence of others, fate, and luck in social learning theory is known as locus of control.

According to Rotter (1966), locus of control is a person's belief in success/failure that occurs in life caused by behavior/actions that come from within himself or come from the influence of others, fate/destiny, and luck that are beyond his control (Sumantri & Iqlima, 2020). Rotter classifies the locus of control into 2, namely the internal locus of control and the external locus of control. According to Kalamu (2021), students with an internal locus of control will be serious in learning, diligently reading books from various sources to find information related to problems faced in the learning process, so that it will affect learning patterns that will have an impact on learning outcomes. Students with an external locus of control, basically have confidence in external factors, such as the influence of others, fate, and luck that can determine success/failure in the learning process that has an impact on learning outcomes.

Based on the above background, researchers are interested in conducting research on the analysis of the mathematical problem-solving ability of SPLDV material in terms of the locus of control of grade VIII students of SMPN 4 Narmada for the 2023/2024 academic year. The locus of control referred to in this study is, the external locus of control is strong, the internal and external locus of control are balanced, and the internal locus of control is strong.

Research Method

This study uses a qualitative descriptive method because this study describes or describes the problem-so lving ability of students of two-variable linear equation system material in terms of locus of control by the way researchers analyze students' problem-solving abilities from representatives of each locus of control who are more inclined in students. Data collection techniques use locus of control questionnaire instruments and valid problem-solving ability test questions. The technique of taking research subjects uses purposive sampling, where the technique of taking research subjects is taken with certain considerations that refer to the purpose of the research (Sugiyono, 2018: 95).

To find out the type of locus of control that is more likely in students, a locus of control questionnaire consisting of 25 statements is first given. Based on these alternative answers, the maximum score obtained by students is 100 and the minimum score is 25. The assessment criteria for the locus of control (L) questionnaire in this study are as follows.

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Table 1 Category locus of control *(L)*

Score	Category
$1 < L \leq 40$	Strong external locus of control
$< L \leq 60$	Balanced internal and external locus of control,
$60 < L \leq 100$	Strong internal locus of control

To determine the level of students' mathematical problem-solving ability, SPLDV material problem-solving ability test questions are first given which consist of 2 description questions that refer to Polya problem-solving steps. The assessment criteria used in this study according to Handayani (2020: 99) are as follows.

Table 2 Problem-solving ability assessment category

Assessment Criteria	Category
$(X < Mi - SDi)$	Low
$(Mi - SDi) \leq X < (Mi + SDi)$	Medium
$(X \geq Mi + SDi)$	High

Description:
X= Score of problem-solving ability
Mi = Ideal mean
SDi = Ideal standard deviation
Problem-solving ability criteria that refer to problem-solving steps according to Polya and assessment guidelines. The test questions presented are in the form of problem-solving questions consisting of 2 description questions with a maximum score of 24 and a minimum of 0.

Result And Discussion

Data collection was carried out in three meetings. The first and second meetings were conducted to collect data on the type of locus of control and the level of solving ability of students. The third meeting was held to collect data on the results of in-depth interviews to reinforce answers that there were doubts in answering the test questions given.

Result

Data on the results of the mathematical problem-solving ability of SPLDV material in terms of the locus of control of grade VIII students of SMPN 4 in the academic year 2023/2024 were obtained as follows.

Table 3 The relationship of locus of control to students' problem-solving abilities

Locus of Control	Problem-solving ability			Number of Students
	High	Medium	Low	
Strong external (EK)	-	2	7	9
Internal and external balanced (IE)	-	4	20	24
Strong internals (IK)	2	23	14	39
Number of Students	2	29	41	72
Percentage	2,78%	40,28%	56,94%	100%

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Based on the results of the analysis, the following data were obtained.

a. There are 9 students with a strong external locus of control. 8 students were only able to reach the step of understanding the problem. While the other 1 student can reach the step of understanding the problem and devising a strategy.
b. There are 24 students with a balanced internal and external locus of control. 18 students were only able to reach the step of understanding the problem, while the other 6 students were able to reach the step of understanding the problem and devising a strategy.
c. There are 39 students with a strong internal locus of control. 19 students were only able to reach the step of understanding the problem, 16 students were able to reach the step of understanding the problem and making problem-solving strategies, and the other 4 students were able to reach the step of understanding the problem, devising a strategy, and carrying out the strategy.

1. Students' Mathematical Problem-Solving Ability With A Strong External Locus of Control

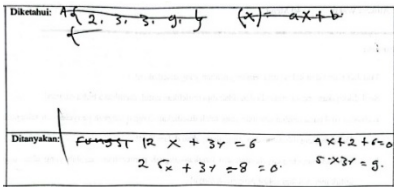

Figure 1 Understanding the problem of EK

At the step of understanding the problem, students with a strong external locus of control only write down the information asked, but not by the problem. Based on the results of the interview, students with a strong external locus of control can name and explain the information known and asked in the question appropriately. Thus, it can be concluded that students with an external locus of control can reach the step of understanding the problem.

When devising a strategy, students with a strong external locus of control do not write down the step (no work). Based on the results of interviews, students with strong external locus of control have not been able to make examples and change them in the form of mathematical equation models, because they feel confused and difficult. Thus, it can be concluded that students with locus of control have not been able to reach the step of devising a strategy.

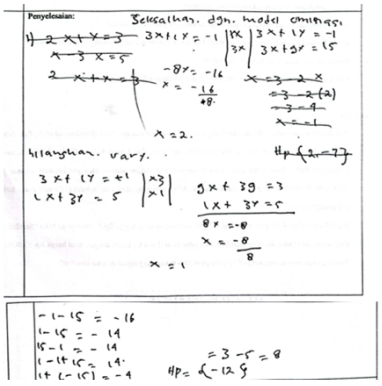

Figure 2 Carrying out the strategy of EK

At the step of carrying out the strategy, students with a strong external locus of control have not been able to apply the solving method used and the equations made are not by the problem so they are wrong as a whole. Based on the results of interviews,

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students with strong external locus of control find it difficult when apply the settlement method used. Thus, it can be concluded that students with a strong external locus of control have not been able to achieve the step of carrying out the strategy.

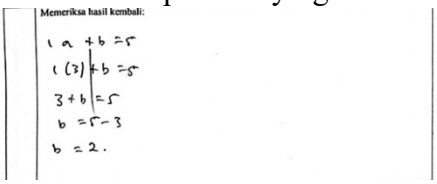

Figure 3 Looking back of EK

At the step of looking back, students with a strong external locus of control write the step, but it is not quite right. Based on the results of student interviews with a strong external locus of control using equations that do not match the problem, so that the solution obtained is not appropriate. Thus, it can be concluded that students with a strong external locus of control have not been able to achieve the step of looking back.

2. Students' Mathematical Problem-Solving Ability With A Balanced Internal And External Locus of Control

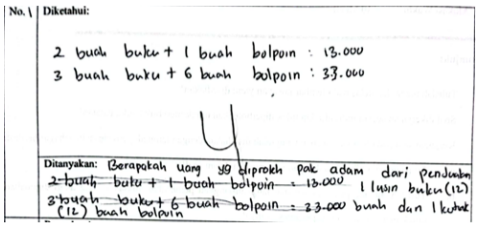

Figure 4 Understanding the problem of IE

At the step of understanding the problem, students with a balanced internal and external locus of control can write down information that is known and asked appropriately and completely. Based on the results of the interview, students with a balanced internal and external locus of control can mention and explain the information known and asked in the question well. Thus, it can be concluded that students with a balanced internal and external locus of control can achieve the step of understanding the problem.

When devising a strategy, students with a balanced internal and external locus of control do not write down the steps to create a problem-solving strategy (no work). Based on the results of interviews, students with a balanced internal and external locus of control can make examples and change them in the form of mathematical models well. Thus, it can be concluded that students with a balanced internal and external locus of control can achieve the step of devising a strategy.

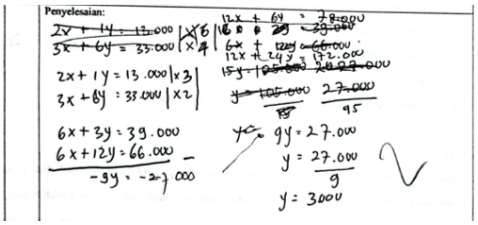

Figure 5 Carrying out the strategy of IE

At the step of carrying out the strategy, students with a balanced internal and external locus of control can write down and determine the solving method used but are only able to determine the value of one of the variables. Based on the results of interviews, students with a balanced internal and external locus of control have not been able to

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explain the settlement strategy to conclude. Thus, it can be concluded that students with a balanced internal and external locus of control have not been able to achieve the step of carrying out the strategy.

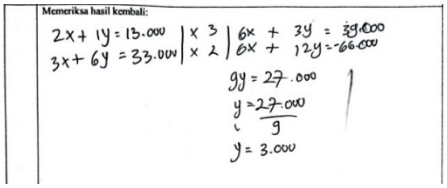

Figure 6 Looking back of IE

At the step of looking back, students with a balanced internal and external locus of control perform the looking back step, but it is not appropriate. Based on the results of student interviews with an internal and external locus of control balanced using the same method as the steps to carrying out the strategy, so that the solutions obtained are not appropriate. Thus, it can be concluded that students with a balanced internal and external locus of control have not been able to achieve the step of looking back.

3. Students' Math Problem-Solving Ability With A Strong Internal Locus of Control

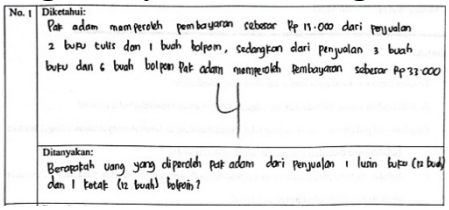

Figure 7 Understanding the problem of IK

At the step of understanding the problem, students with a strong internal locus of control can write down information that is known and asked appropriately and completely. Based on the results of interviews, students with a strong internal locus of control can mention and explain the information known and asked in the question well. Thus, it can be concluded that students with a strong internal locus of control can achieve the step of understanding the problem.

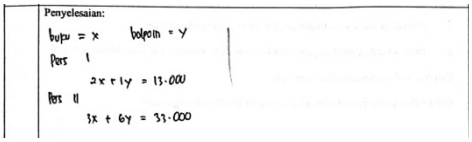

Figure 8 Devising a strategy of IK

When devising a strategy, students with a strong internal locus of control can write down the steps, but it is not quite right. Based on the results of interviews, students with a strong internal locus of control can make examples and change them in mathematical equation models precisely and completely. Thus, it can be concluded that students with a strong internal locus of control can achieve the step of devising a strategy.

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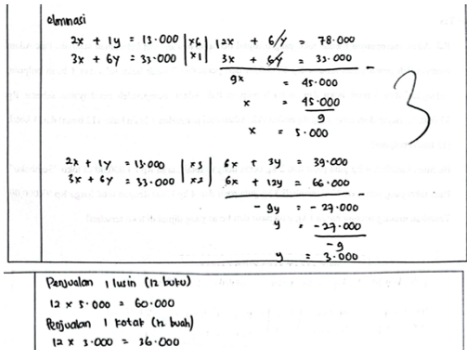

Figure 9 Carrying out the strategy of IK

At the step of carrying out the strategy, students with a strong internal locus of control can write down the step, but it is less complete. Based on the results of interviews, students with a strong internal locus of control can explain a series of settlement strategies used to conclude well. Thus, it can be concluded that students with a strong internal locus of control can achieve the step of carrying out the strategy.

At the step of looking back, students with a strong internal locus of control have not been able to perform the step (no work). Based on the results of interviews, students with strong internal locus of control have not been able to carry out this step because they are not used to it. In addition, students with a strong internal locus of control are confident that the solution obtained is correct. Thus, it can be concluded that students with a strong internal locus of control have not been able to achieve the step of looking back.

Discussion

1. Analysis of Students' Mathematical Problem-Solving Abilities With A Strong External Locus of Control

Based on the results of the study, students with a strong external locus of control were only able to achieve one of the four problem-solving steps according to Polya, namely the step of understanding problems with low problem-solving ability categories.

At the step of understanding the problem, students of strong external locus of control can name and explain the steps to understand the problem well even though they do not write accurately and completely. In line with Nafisah, Turmuzi, Triutami, & Azmi (2022), students find it difficult to understand the problems contained in the problem, so they are not able to identify the information known and asked in the problem and are not familiar with contextual questions.

When devising a strategy, students have a strong external locus of control that has not been able to make a model and convert it into a model of a mathematical equation through the information that has been identified. In line with Subarinah, Hikmah, & Azmi (2019), students with low problem-solving skills have not been able to make models and change the information identified in the form of mathematical equation models.

At the step of carrying out the strategy, students of a strong external locus of control have not been able to achieve that step, they are only able to determine the methods used to help find solutions to problems. In line with Nafisah et al (2022), students with low and moderate problem-solving abilities have not been able to complete the application of the solution method used correctly, so they have not been able to find solutions to these problems.

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In addition, strong external locus of control students have not been able to recheck strategies because these students do not know and are not used to re-checking steps. In line with Agustina, Subarinah, Hikmah, & Amrullah (2021), students with low problem-solving skills have not checked again because these students do not know how to do these steps.

Thus, it can be concluded that strong external locus of control students are only able to achieve the step of understanding problems with problem-solving ability being in the low category. This happens because students have a strong external locus of control that makes little effort, so it is easy to give up when given problem-solving problems. In line with Kalamu (2021), where someone with an external locus of control tends to hope regardless of the effort they have made, whether the results they get are proportional to the effort they put in or not. In addition, students' external locus of control is strong in solving a problem often depending on others. In line with Abzani and Leonard (2017), stated that students with an external locus of control tendencies often need the help of others in solving the problems face.

Based on this, it can be concluded that strong external locus of control students have the characteristics of less effort, less active in seeking information related to the problems faced, and easily influenced by others. This is in line with the opinions of Kalamu et al (2018), and Ulima (2022), the characteristics of a person with a strong external locus of control tendency, including working hard, lacking initiative in finding relevant information in solving a problem, everything that is achieved comes from external factors such as fate/destiny and luck, failures experienced due to unluck, and easily influenced by others.

2. Analysis of students' mathematical problem-solving abilities with a balanced internal and external locus of control

Based on the results of the study, students with a balanced internal and external locus of control were able to achieve two of the four problem-solving steps according to Polya, namely the step of understanding the problem and making problem-solving strategies with the category of medium problem-solving ability.

At the step of understanding the problem, students with a balanced internal and external locus of control can identify the elements that are known and asked in the problem well. In line with Nafisah et al (2022), students with medium problem-solving ability can understand problems well and do not find them difficult.

When devising a strategy, students of balanced internal and external locus of control can make examples and change them in mathematical equation models well, even though they do not write them completely. In line with Khatami et al (2022), students with medium problem-solving ability can take steps to make problem-solving strategies even though they do not write them completely, but can mention and explain these steps well.

At the step of carrying out the strategy, balanced internal and external locus of control students have not been able to implement problem-solving strategies properly, because the application of the solving method used is not appropriate and complete. In line with Nafisah et al (2022), students with medium problem-solving ability have not been able to complete the application of the solution method used correctly, so they have not been able to find solutions to these problems.

In addition, balanced internal and external locus of control students have not been able to do the looking back step because they do not know and are not used to doing the looking back step. In line with Agustina et al (2021), students with medium problem-

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solving ability have not checked again because these students do not know how to do these steps.

Thus, it can be concluded that students with a balanced internal and external locus of control can achieve the step of understanding the problem and making problem-solving strategies. This happens because students have a balanced internal and external locus of control, lack confidence in their abilities, and are less active in finding and digging for information related to the problems faced. In line with Kalamu (2021), where someone will easily give up when they fail to achieve their goals. In addition, they tend to expect more help from others. In line with Abzani and Leonard (2017), states that students with external locus of control tendencies often need the help of others in solving the problems faced, especially solving mathematical problems.

Based on this, it can be concluded that students of internal and external locus of control are balanced have the characteristics of less effort, are less active in seeking information related to the problems faced, and are easily influenced by others. This is in line with the opinions of Kalamu et al (2018), and Ulima (2022), the characteristics of a person with a tendency to balance internal and external locus of control, including working hard, lacking initiative in finding relevant information in solving a problem, everything that is achieved comes from external factors such as fate/destiny and luck, failure experienced due to unluck, and easily influenced by others.

3. Analysis of Students' Mathematical Problem-Solving Abilities With A Strong Internal Locus of Control

Based on the results of the study, students with a strong internal locus of control were able to achieve three of the four problem-solving steps according to Polya, namely the steps of understanding problems, devising a strategy, and carrying out the strategy with high problem-solving ability categories.

At the step of understanding the problem, students with a strong internal locus of control can take the step of understanding the problem well without feeling difficult. In line with Nafisah et al (2022), students with high problem-solving skills can write, mention and explain information known and asked in questions appropriately and completely.

When devising a strategy, students with a strong internal locus of control can do this step by making examples and converting them into mathematical equation models even though they do not write completely and precisely. In line with Khatami et al (2022), students with moderate problem-solving skills can carry out steps to make problem-solving strategies even though they are sometimes incomplete and precise in writing them down.

At the step of carrying out the strategy, students with an internal locus of control can take steps to implement problem-solving strategies well. In line with Khatami et al (2022), students with high problem-solving skills can carry out problem-solving strategies through a series of calculation processes for the application of methods used well.

Meanwhile, in the step of looking back, students with a strong internal locus of control have not been able to do it properly, because they feel confused and not used to the step. In line with Agustina et al (2021), students with high problem-solving abilities have not been able to look back step because they do not know how to test the correctness of the solutions obtained through a series of problem-solving processes.

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Thus it can be concluded that students with a strong internal locus of control can achieve the step of understanding problems, making problem-solving strategies, and implementing problem-solving strategies. This happens because students have a strong internal locus of control trying hard to find solutions to problems, are active in finding and exploring information related to the problems faced, and believe that the success they get comes from their abilities. In line with Nurfitriyanti, Rosa, and Nursa'adah (2020), where someone with a higher internal locus of control will be responsible for the solution of the problem at hand, and better prepared to face the problem. They believe that their success comes from their hard work without the help of others. In line with Kalamu (2021), someone with a tendency towards internal locus of control can control the behavior/actions they take, tends not to be influenced by others, and believes that their efforts are successful. Students' strong internal locus of control tends to be able to influence others around them. In addition, they tend to feel satisfied with the results they get from their efforts. This is in line with the opinion of Kalamu &; Djafar (2022), that students with a tendency to internal locus of control tend to feel satisfied with the results obtained from their hard work.

Based on this, it can be concluded that strong internal locus of control students have the characteristics of trying hard, being active in seeking information related to the problems faced, and not being easily influenced by others. This is in line with the opinions of Kalamu, et al (2018), and Ulima (2022), the characteristics of someone with an internal locus of control tendency include: working hard, having initiative in finding relevant information in solving a problem, and everything achieved comes from his efforts, satisfied with the work achieved, and responsible.

Conclusion

Based on the results of research and discussions that refer to the research objectives, the ability to solve mathematical problems of SPLDV material in terms of the locus of control of grade VIII students of SMPN 4 Narmada in the academic year 2023/2024 can be concluded: (1) students with a strong external locus of control are only able to achieve one of Polya's four problem-solving ability steps, namely the step of understanding the problem. This happens because, students have a strong external locus of control less effort, and less active in finding information related to the problems they are facing, and are easily influenced by others.(2) students with a balanced internal and external locus of control can achieve two of Polya's four problem-solving steps, namely understanding problems and devising a strategy. This happens because students have a balanced internal and external locus of control, less effort, less active in finding information related to the problems at hand, so they do not explore their abilities and still depend on the help of others. (3) students with a strong internal locus of control can achieve three of Polya's four problem-solving steps, namely understanding the problem, devising a strategy, and carrying out the strategy. This happens because students have a strong internal locus of control easily satisfied with the results they get with the effort they make.

Recommendation

For future researchers who are interested in researching problem-solving abilities based on locus of control, it is better to increase the number of subjects and be able to find new variables because this research is still on a small scale, where the subjects and locus of control variables used are still few.

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