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ANALYSIS OF STUDENTS' MATHEMATICAL CRITICAL THINKING PROCESS IN SOLVING PROBLEMS ON SYSTEM OF LINEAR EQUATIONS IN TWO VARIABLES THROUGH SCAFFOLDING AT DARUSSOLAH SINGONJURUH HIGH SCHOOL

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ABSTRACT

The mathematical critical thinking process is a student's thinking ability in analyzing and evaluating information to reach valid conclusions. In solving mathematical problems, critical mathematical thinking process skills are needed for students to solve more difficult problems. The application of scaffolding is considered appropriate to help slowly improve their mathematical critical thinking process abilities until they are finally able to solve problems independently. This research uses a qualitative approach with descriptive research type. The subjects determined in this research were four Darussolah Singonjuruh High School students who had been selected by mathematics teachers at the school, with details of 2 students with high abilities and 2 students with medium abilities. Data collection was carried out by conducting tests before and during the scaffolding, and accompanied by interviews. Data analysis is carried out interactively and continues until saturation. The research results obtained before scaffolding showed that there was only one subject who could complete it well. Then, through scaffolding the abilities of the four subjects slowly increased to fulfill the four stages of the thinking process being studied and the percentage scores for the four subjects were achieved. Providing scaffolding is considered to be able to improve students' thinking processes in solving problems regarding two-variable linear equation systems.

Keywords: Mathematical Thinking, Problem Solving, SPLDV, Scaffolding.

1. Introduction

Mathematics is a science or knowledge of learning or logical thinking that is needed by humans to live, which underlies the development of modern technology. (Daryanto Setiawan, 2018). The purpose of learning mathematics is for students to understand mathematical concepts, facts, principles, operations, relationships, be able to explain the relationship between concepts and apply concepts or algorithms, flexibly, accurately, efficiently, and precisely, in the ability to process mathematical thinking. (Malikah et al., 2022). This ability needs to be developed so that students can more easily understand the concept of understanding a problem well, reason well, and analyse a problem so that they can solve problems based on the concepts they have learned. (Masnia & Amir, 2019).

Mathematical critical thinking is students' thinking in analysing and evaluating information to reach a valid conclusion. (Rosliani & Munandar, 2022). Mathematical critical thinking can train students to be good at reading the situation of each problem, evaluating and drawing conclusions on certain conditions so that the knowledge that students build is stronger and not easily forgotten. The ability to solve mathematical problems according to (Rosita & Singaperbangsa Kaawang, 2019) It is an attempt to find a way out of a difficulty and achieve a goal that cannot be achieved immediately. In solving mathematical problems, the emphasis is on what the problem is and how to solve the problem systematically and logically. (Maskar et al., 2022). When facing a problem, students have the opportunity to formulate the

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problem and choose their own approach method in an effort to solve the problem, in this case students are expected to use their mathematical thinking process skills in every step in solving the problems they do. (Syafira et al., 2022). Mathematical problem solving is also the most important goal in learning mathematics because indirectly the level of creativity and originality of students will be able to increase. (Novtiar & Aripin, 2017), (Zulfah, 2017).

Students' mathematical critical thinking in solving mathematics problems is not fulfilled in mathematics learning because during the learning process, students do not pay much attention to the teacher. The reason is that students do not understand the explanation delivered by the teacher in front. Therefore, to improve students' mathematical thinking process, there needs to be a method that can help students to achieve it. Scaffolding is considered capable of helping students improve their thinking process. Scaffolding is one of the concepts of human development initiated by Vygotsky about Zone Proximal Development (ZPD). (Putu Suardipa, 2020) Vygotsky viewed scaffolding as a learning strategy, and defined it as "The role of teachers and others in supporting the learner's development and providing support structures to get to that next stage or level". Scaffolding is a practice that has its basis in Vygotsky's concept, the level of development itself is one of using an individual's current intellectual functioning and ability to learn specifically on his or her own terms (Nugroho, 2017), (Atikurrahman et al., 2019).

To determine the improvement of students' mathematical thinking process in solving mathematical problems, scaffolding is carried out in solving mathematical problems by providing a large amount of assistance and direction gradually, then reducing the assistance gradually to provide opportunities for students to take over greater and greater responsibility, after they are able to solve the problem on their own.

Knowing students' thinking processes when solving mathematics problems is very important, because by knowing students' thinking processes, teachers can find out the location and types of difficulties/errors made by students. Difficulties or mistakes made by students can be used as a source of learning information and understanding for students. In this case, the teacher acts as a motivator and guides students when solving problems, the teacher also provides assistance and direction to students so that they can reflect and follow up, able to improve their solutions appropriately.

Based on the description above, it is important to conduct further research on the Analysis of Students' Mathematical Critical Thinking Process in Solving Problems on the Material of Two-Variable Linear Equation Systems Through Scaffolding at Darussolah Singonjuruh High School.

2. Research Methods

This research uses a qualitative approach with descriptive research type. The subjects determined in this study were 4 students of SMA Darussolah Singonjuruh who had been selected by the mathematics teaching teacher at the school, with details of 2 students with high ability and 2 students with medium ability. Data collection was done by conducting tests before and during scaffolding, and accompanied by interviews. Data analysis was conducted interactively and continued until saturation.

3. Results and Discussion

The problem solving stages studied in this study, namely (1) understanding the existing problem; (2) stating data/information in appropriate mathematical sentences; and (3) using and connecting previously learned mathematical concepts; and (4) checking/rechecking the calculation results that have been obtained.

Mathematical Critical Thinking Process of High Ability Subjects. The difference in the critical thinking process of high ability subjects in solving mathematical problems before scaffolding only made a few mistakes in solving them, even in solving the first problem Subject 1 (S1) did not need to be given scaffolding because the percentage obtained before scaffolding was very low. The

scaffolding has been achieved, and the thinking process has fulfilled the four stages of the mathematical thinking process used in this study. The mistakes made by subject 1 (S1) in both problems are only found in the second problem, Subject (S1) forgot to include the memorisation in solving the problem, this can be seen in the following

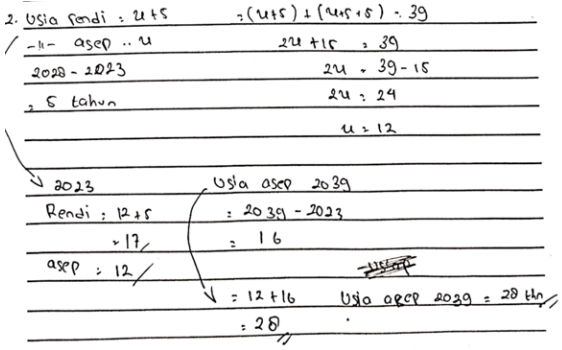

figure:

Figure 1. subject 1's solution to the second problem before scaffolding

From the results of the completion and review of S1 it has been shown that S1's thinking structure is actually in accordance with the structure of the problem given, his thinking process has actually fulfilled the four stages of problem solving expected. However, in solving this second problem S1 did not include a memorisation in completing the solution.

While the mistakes made by subject 2 (S2) in the first problem forgot to include the memorisation in solving the problem. and the error in the second problem, S2 was wrong in determining Asep's age.

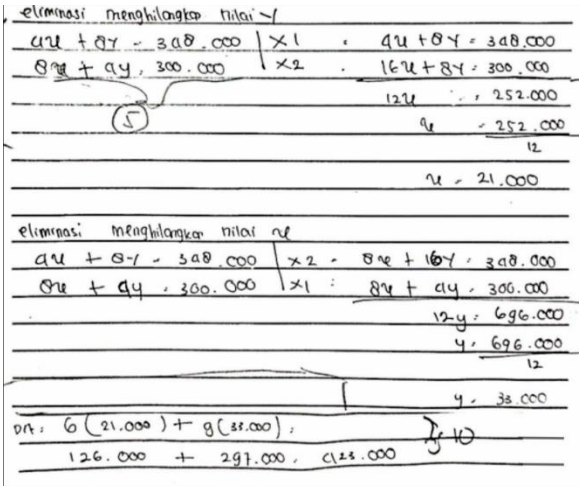

Figure 2. Subject 2's solution to the first problem before scaffolding

From the results of the solution and the review, it can be seen that S2's thinking process has fulfilled the four stages of problem solving, but still forgot to provide a visualisation in the process.

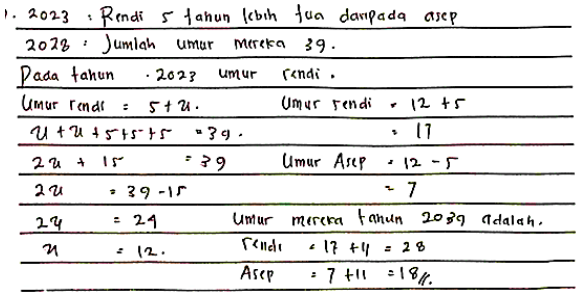

Figure 3. Subject 2 (s2)'s solution to the second problem before scaffolding

From the results of the completion and review of Subject 2 (S2), it was seen that S2's thinking structure was not in accordance with the structure of the problem given, his thinking process also did not fulfil the four stages of problem solving expected. This can be seen in the results of the solution of not being able to identify the data/information he obtained. S2 did not utilise the data he obtained, namely the ages of Rendi and Asep. This shows that S2 has not been able to use the mathematical concepts he has learnt in solving the second problem. He thought that by obtaining x, then he added and subtracted the result of x with the difference between the two years, so he also had difficulty continuing his work. Then he also did not review the problem he solved, so he did not realise that he had made many mistakes.

After gradual scaffolding, the mathematical critical thinking process of S1 and S2 has improved. The percentage obtained from the S1 and S2 test results has increased from before scaffolding to after scaffolding is given. This can be seen in the following figure:

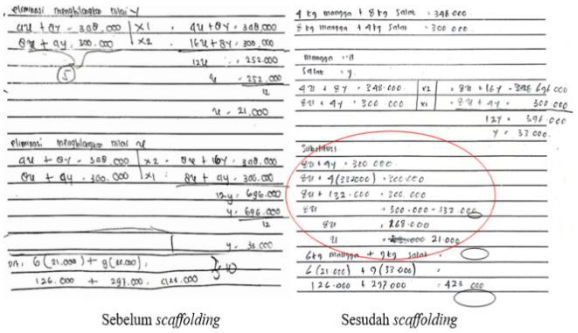

Figure 4. subject 2's solution to the first problem before Sf 1 and after going through Sf 1

By going through Scaffolding, it can be seen that S2 only changed the method he used in solving the problem, which at first he used the elimination method all, after going through Scaffolding he used the substitution method because he just knew the method and he also wrote the memorisation of the mango and salak fruit which at the time before scaffolding he forgot to write it down.

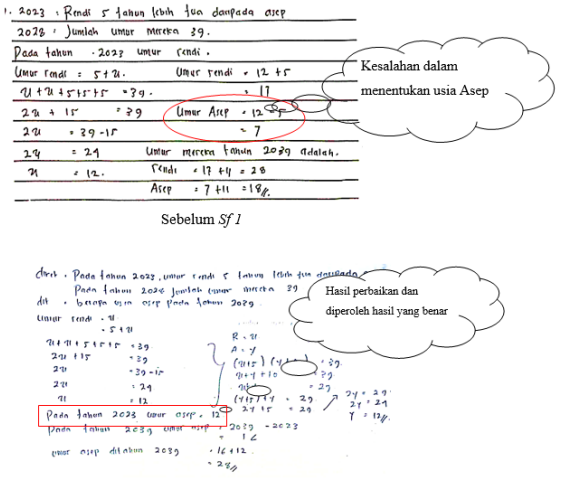

Figure 5. S2's solution to the second problem before Sf 1 and after going through Sf 1

In this first stage of scaffolding (Sf 1), it can be seen that S2 immediately realised his mistake and could correct his solution and obtain the correct result. The mathematical thinking process of S1 and S2 has fulfilled the four stages of problem solving that are the reference for increasing the mathematical thinking process in this study, namely (1) understanding the problem; (2) stating data/information in appropriate mathematical sentences; (3) using and connecting previously learned mathematical concepts; and (4) checking/rechecking mathematical concepts that have been previously learned; and (5) checking/rechecking mathematical concepts that have been previously learned.

mathematical concepts that have been learnt previously and (4) checking/rechecking the calculation results that have been obtained. The percentage that shows the improvement of mathematical thinking process in solving both problems is shown in the following figure:

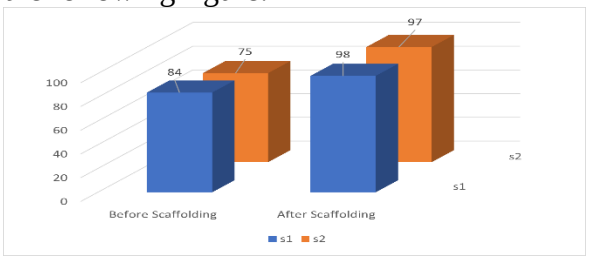

Figure 6. Mathematical Thinking Process Results of Subject High before and after scaffolding

Mathematical Critical Thinking Process of Medium Ability Subjects

The difference in the critical thinking process of medium ability subjects in solving mathematics problems before scaffolding only made a few mistakes in solving them. Errors made by subject 3 (S3) are found in both problems. In the first problem, S3 was less careful in calculating the price of salak and S3 did not complete the instructions given in the problem.

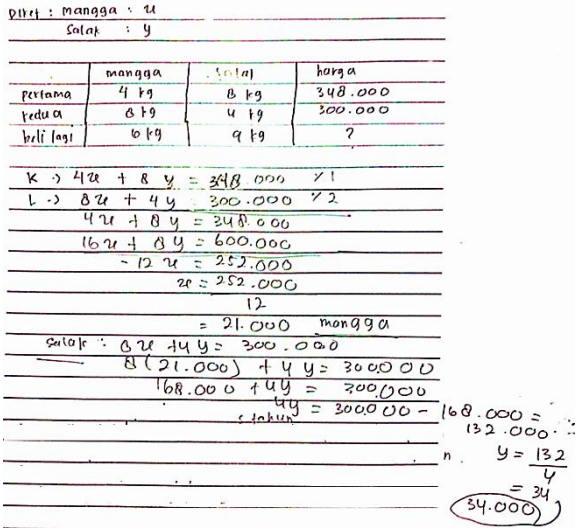

Figure 7. subject 3's solution to the first problem before scaffolding

In the second problem, S3 is correct in providing answers, but S3 cannot provide evidence of the problems solved. Similarly, subject 4 (S4) also had two errors in solving the problems given. In the first problem, S4 was also less careful in calculating the price of salak so that the final solution of S4 also contained errors. In the second problem, S4 could not solve the given problem at all.

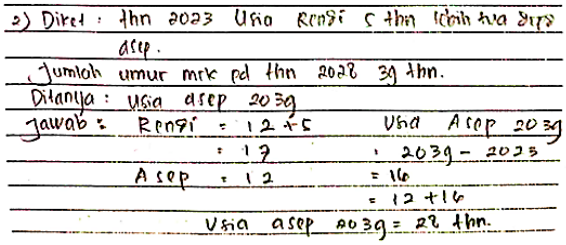

Figure 8. subject 3's solution to the second problem before scaffolding

After the provision of scaffolding which is done gradually, the mathematical thinking process of S3 and S4 has increased. obtained from the test results S3 and S4 have increased from before scaffolding to after scaffolding is given. This is supported by the results of tests and interviews conducted. Then, in solving the problem, the mathematical critical thinking process of S3 and S4 fulfils the four stages of problem solving which is a reference to the increasing mathematical thinking process in this study namely (1) understanding the problem (2) stating data/information in appropriate mathematical sentences (3) using and connecting previously learned mathematical concepts and (4) checking/rechecking the calculation results that have been obtained. The results showing the improvement of the mathematical thinking process in solving the two problems are shown in the following figure:

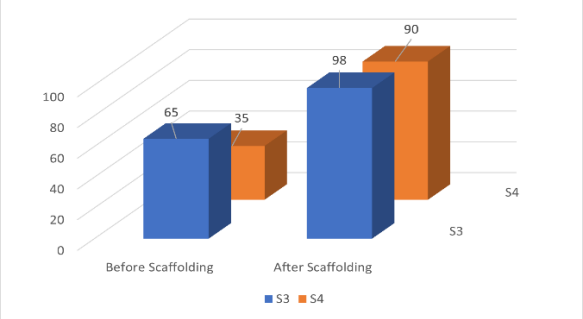

Figure 9. Mathematical Thinking Process of Medium Subject before and after scaffolding

4. Conclusions

In solving problems, the subjects' critical thinking processes have not fulfilled the four stages of Polya's problem solving model and the four dimensions of problem solving studied in this study. Only subject 1 managed to fulfil the four stages of problem solving studied in this study without scaffolding. By providing scaffolding, each subject can slowly understand the meaning of the problem given. The subject's mathematical critical thinking process in solving problems has fulfilled all four stages of the Polya model problem and all four dimensions of problem solving. They can finally realise the mistakes they made in solving previous problems and can solve mathematical problems well.

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