

AN ANALYSIS OF STUDENTS' CRITICAL THINKING ABILITIES IN SOLVING PROBLEMS SOCIAL ARITHMETICS JUNIOR HIGH SCHOOL

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ABSTRACT

Critical thinking skills are necessary because Critical thinking is a form of high-level thinking ability that all students must have, especially in learning mathematics. However, students' Critical thinking skills are honed less during the learning process. Teacher efforts to facilitate students to practice Critical thinking skills are indispensable. So that teachers need a picture of the ability to think critically as a reference to train these skills. To that end, the study aims to describe students' thinking skills in solving social arithmetic problems, especially single-interest matters. This type of research is descriptive qualitative research. The subject of this research is PTS students for the odd semester of the 2020/2021 class VII academic year from a state junior high school in Sleman district. The instruments of this research are problem-solving questions as well as observations and interviews. The results of the research show that the three students have high critical thinking abilities because they can fulfill all indicators of critical thinking abilities in solving single-interest problems. Where all indicators of critical thinking abilities can be met by the three students with varied problem-solving processes.

Keywords: Critical Thinking Skills, Problem-Solving, Social Arithmetic

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INTRODUCTION

Critical thinking is a form of high-level thinking ability that all students must have, especially in learning mathematics (Zetriuslita, Wahyudin, & Dahlan, 2018; Yılmaz-Özcan & Tabak, 2019; Almulla, 2018; Azizah & Widjajanti, 2019; Setyaningsih & Abadi, 2018). Students are required to have critical thinking skills so that they can easily build their own knowledge in learning mathematics (Farib, Ikhsan, & Subianto, 2019). Critical thinking skills familiarize students with developing rational attitudes in determining the best decisions (Farib, Ikhsan, & Subianto, 2019; Firdaus, Nisa, & Nadhifah, 2019). Critical thinking allows students to study problems systematically, face challenges in an organized manner, formulate questions innovatively, and design the best solutions (Abdurahim, 2016). Students who have critical thinking skills are able to solve problems effectively (Peter, 2012) and do not easily take things they see and hear for granted (Hardiyanto & Santoso, 2018). Students who have critical thinking skills will always monitor their thinking, ensuring that the answers or conclusions they

make are not wrong (Miatun & Khusna, 2020). Thus, it is important for students to have and master critical thinking skills, especially to help solve problems in mathematics learning.

Considering the importance of critical thinking skills, teachers are obliged to create learning situations that can support students to develop these abilities. However, one of the class VII mathematics teachers at a State Middle School in Sleman district stated in an interview that learning oriented towards developing critical thinking skills had not been carried out routinely in his class. This is as stated by previous researchers that the facts that occur in the field show that learning that is oriented towards training students' critical thinking skills is still lacking or has not been fully implemented in the learning process (Azizah & Widjajanti, 2019; Putri, Sumardani, Rahayu, & Hajizah, 2020). The results of observations regarding the learning process have not created situations and conditions for students to think critically which have been documented by a number of previous researchers, including teachers only explaining, students copying notes, memorizing formulas, and being given routine or procedural practice questions (Abdurahim, 2016); teachers dominate learning and are accustomed to providing practice questions that apply concepts (Agus, 2019); the teacher presents material and fully guides students in solving problems (Firdaus, Nisa, & Nadhifah, 2019); and the teacher provides a brief explanation and gives examples of solving simple problems (Salim & Maryanti, 2017). Teachers have not provided many opportunities for students to construct their own knowledge and carry out investigations in learning (Ucisaputri, Nurhayati, & Pagiling, 2020). Therefore, students' critical thinking abilities are currently still low.

One of the class VII mathematics teachers at a state junior high school in Sleman district said that the results of the assessment of critical thinking skills that had been carried out (included in the daily assessment) did not meet expectations. This also happens in other places, several previous researchers have documented the results of their research regarding the low critical thinking abilities of today's students. Researchers assess students' critical thinking abilities as low or less than optimal because students have not been able to meet the critical thinking criteria needed to solve problems, and often experience difficulties in working on questions that require the ability to analyze and solve problems (Ucisaputri, Nurhayati, & Pagiling, 2020); only able to master several indicators of critical thinking abilities (Miatun & Khusna, 2020); less able to think deeply, less thorough, and difficulty completing practice questions that are different from the examples (Winarso & Dewi, 2017). Regarding documentation from previous researchers which shows low critical thinking skills, including the results of diagnostic tests showing that 74.28% of students have difficulty drawing curves from a polar equation and calculating the area of the area bounded by a given polar equation (Asmar & Delyana, 2020); students are less able to analyze questions that require further thought processes, apply various strategies in solving problems, provide reasons, and draw conclusions from a problem in trigonometry material (Muslimahayati, 2020); the percentage of achievement of critical thinking indicators in integral material is less than 50% (Putri, Sumardani, Rahayu, & Hajizah, 2020); Of the 32 students, only 10 of them were able to detect errors, which is an indicator of critical thinking abilities (Setyaningsih & Abadi, 2018). Thus, comprehensive efforts are needed from teachers to overcome this problem.

Low critical thinking skills are an important problem in mathematics education (Mujib, 2016). Critical thinking skills should continue to be developed in the process of learning activities (Putri, Sumardani, Rahayu, & Hajizah, 2020). Critical thinking skills can be trained by giving questions as often as possible in the form of problems that require students to think critically in solving them (Sulistiyorini & Napfiah, 2019). In the teaching materials developed by a class VII mathematics teacher at a state junior high school in Sleman district, it can be seen that there is a teacher's effort to encourage students to think critically, namely by providing practice questions on social arithmetic problems related to sales and purchase material.

However, during the interview the teacher stated that in the social arithmetic material students often experienced difficulties in the interest material. The teacher suspects that difficulties occur because students have never done activities that are closely related to flowers. Thus, critical thinking habits also need to be trained by providing practice questions on social arithmetic problems related to interest material. Before training critical thinking skills, an overview of students' critical thinking skills, especially those with high academic abilities, is needed (Sulistyorini & Napfiah, 2019). Because students with high academic abilities can be used as a reference in evaluating learning activities. This is in line with Sulistyorini & Napfiah (2019) that students who have high academic abilities can be used as a reference for teachers in evaluating, managing and improving learning. Based on the background above, the aim of this research is to describe students' critical thinking abilities in solving social arithmetic problems, especially in single interest material. The analysis of critical thinking skills in this research is focused on students who have high academic abilities, which aims to obtain an overview of the extent to which critical thinking ability indicators can be met in solving social arithmetic problems. Because this picture needs to be known before the teacher begins to train critical thinking skills by giving questions with interesting material that requires students' critical thinking in solving them.

METHOD

This type of research is descriptive qualitative research, which aims to describe critical thinking skills in solving social arithmetic problems, namely single flowers. The subject of this research is PTS students for the odd semester of the 2020/2021 class VII academic year from a state junior high school in Sleman district. The description of the achievement of critical thinking ability indicators can then be used by teachers as a reference in training students' critical thinking skills at the school. The instrument of this research is problem solving questions. The problem solving question instrument used refers to indicators of critical thinking abilities.

The critical thinking ability indicators in this research are based on the indicators formulated by Facione (in Ucisaputri, Nurhayati, & Pagiling, 2020), namely (1) interpretation: students understand the problem, demonstrated by writing information that is known and asked about the question correctly; (2) analysis: students know the steps in solving problems shown through data collection activities based on existing information to find something related to solving the problem (question); (3) evaluation: students write down problem solutions completely and accurately when carrying out calculations; (4) inference: students draw conclusions from the results of solving problems correctly; (5) explanation: students write down the final results and provide reasons for the answers given; and (6) self-regulation: students recheck the answers they have written. The problem solving problem is in the form of an order to determine the percentage of loan interest each month by knowing the size of the loan and the amount of money that has been deposited until the loan is paid off. Details of the problem solving questions can be seen in Figure 1. Next, the results of solving the problem solving questions are used to describe students' critical thinking abilities in solving single interest problems.

Ibu Nita meminjam modal usaha di bank Makmur sebesar Rp 36.000.000,00 untuk mengembangkan usaha kulinernya. Angsuran rutin dibayar pada setiap bulan selama 1 tahun dengan nominal yang sama. Setelah dihitung ternyata besar uang yang telah disetorkan sampai pinjaman lunas mencapai Rp 44.640.000,00. Besar bunga pada setiap bulan adalah ... %.

Figure 1. Problem Solving Questions

RESULT AND DISCUSSION

Description of critical thinking skills in solving social arithmetic problems, namely the single interest of the three students, refers to Table 1.

Table 1. Description of Critical Thinking Ability Indicators in Solving Single Interest Problems

Solution to problem	Indicators of Critical Thinking Ability	Description
Understand the problem	Interpretation: students understand the problem demonstrated by writing information that is known and asked about the problem correctly	Write down the information that is known and asked about from the question
Make plans	Analysis: students know the steps in solving a problem shown through data collection activities based on existing information to find something related to solving the problem (question)	Type 1: Determine the amount of loan interest every 1 year, then the amount of loan interest every 1 month Type 2: Determine the amount of loan interest every 1 year, then the percentage of loan interest every 1 year Type 3: Determine the amount of installments (without interest) every 1 month and the amount of installments (with interest) every 1 month, then the amount of interest every 1 month
Implement planning	Evaluation: students write down problem solutions completely and accurately when carrying out calculations Inference: students draw conclusions from the results of solving problems correctly Explanation: students write down the final results and provide reasons for the answers given	Determine the percentage of loan interest every 1 month Write a conclusion from the answers you have obtained, starting with the words "So,..." Write down the answers you have obtained along with the reasons for the answers given

Check again	Self-regulation: students check the answers they have written	Double-check the steps to solve the problem and the calculations to avoid mistakes
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Student 1

At the stage of understanding the problem, students 1 are able to write down the information they know and are asked about from the problem completely and accurately. Student 1 writes down the information known from the question, namely the size of the loan, the amount of money deposited until the loan is paid off, and the installment time. Apart from that, student 1 wrote down the information asked for in the question, namely the percentage of interest on the loan each month. In this way, student 1 can fulfill the first indicator of critical thinking ability, namely interpretation.

At the planning stage, student 1 knows the steps in solving a problem shown through data collection activities based on existing information to find something related to solving the problem (question). Based on the information known from the question, namely the size of the loan and the amount of money deposited until the loan is paid off, new information is obtained, namely the amount of interest on the loan every 1 year. Furthermore, through this new information, a large percentage of loan interest is obtained every 1 year. In this way, student 1 can fulfill the second indicator of critical thinking ability, namely analysis.

At the stage of implementing planning, student 1 writes down the problem solutions completely and performs calculations correctly. Based on the percentage of interest on the loan every 1 year that has been obtained, student 1 can determine the percentage of interest on the loan every 1 month correctly. So that student 1 can fulfill the third indicator of critical thinking ability, namely evaluation. Next, student 1 writes a conclusion from the answers they have obtained, starting with the words "So,...." correctly. When writing conclusions, student 1 adds reasons for the answers given correctly. Thus, student 1 can fulfill the fourth and fifth indicators of critical thinking skills, namely inference and explanation. The inference indicator is fulfilled because student 1 can draw conclusions from the results of solving the questions correctly. Meanwhile, the explanation indicator can be fulfilled because student 1 can write down the final results along with the reasons for the answers given correctly.

At the re-checking stage, student 1 is considered to have re-checked the steps for solving the questions and the calculation results that have been written down to avoid errors. Because no errors were found from student 1 in solving the questions. In this way, student 1 can fulfill the sixth indicator of critical thinking ability, namely self-regulation. Regarding the steps for solving the single flower problem that have been carried out by student 1, it can be seen in Figure 2.

4. Diketahui: Modal = Rp 36.000.000,00
 Modal + Bunga = Rp 44.640.000,00
 Angsuran rutin = Setiap bulan selama 1 tahun

Ditanyakan: Besar bunga setiap bulan dalam bentuk persentase

Langkah-langkah Penyelesaian:

$$\begin{array}{r} \text{Bunga} = \text{Rp } 44.640.000,00 \\ \quad \text{Rp } 36.000.000,00 \quad - \\ \hline \text{Rp } 8.640.000,00 \end{array}$$

$$\text{Bunga (\%)} = \frac{8.640.000}{36.000.000} \times 100 \%$$

$$\text{Bunga setahun} = 24 \%$$

$$\text{Bunga setiap bulan} = 24 \% : 12 = 2 \% \text{ per bulan}$$

Jadi besar bunga pada setiap bulan adalah 2% karena besar bunga setahun 24%.

Figure 2. Problem solving steps by students 1

Student 2

At the stage of understanding the problem, student 2 is able to write down the information known and asked about from the problem completely and accurately. Student 2 writes down the information known from the question, namely the size of the loan, the installment time, and the amount of money deposited until the loan is paid off. Apart from that, student 2 wrote down the information asked about in the question, namely the percentage of interest on the loan each month. In this way, student 2 can fulfill the first indicator of critical thinking ability, namely interpretation.

At the planning stage, student 2 knows the steps in solving a problem shown through data collection activities based on existing information to find something related to solving the problem (question). Based on the information known from the question, namely the size of the loan and the amount of money deposited until the loan is paid off, new information is obtained, namely the amount of interest on the loan every 1 year. Furthermore, through this new information, the amount of loan interest obtained every 1 month is obtained. In this way, student 2 can fulfill the second indicator of critical thinking ability, namely analysis.

At the stage of implementing planning, student 2 writes down the problem solutions completely and performs calculations correctly. Based on the amount of interest on the loan every 1 month that has been obtained, student 2 can determine the percentage of interest on the loan every 1 month correctly. In this way, student 2 can fulfill the third indicator of critical thinking ability, namely evaluation. Next, student 2 wrote a conclusion from the answers they had obtained, starting with the words "So,...." correctly. When writing conclusions, student 2 adds reasons for the answers given correctly. Thus, student 2 can fulfill the fourth and fifth indicators of critical thinking skills, namely inference and explanation. The inference indicator is fulfilled because student 2 can draw conclusions from the results of solving the questions correctly. Meanwhile, the explanation indicator can be fulfilled because student 2 can write down the final results along with the reasons for the answers given correctly.

At the re-checking stage, student 2 is considered to have re-checked the steps for solving the questions and the calculation results that have been written down to avoid errors. Because no mistakes were found from students in solving the questions. In this way, student 2 can fulfill the sixth indicator of critical thinking ability, namely self-regulation. Regarding the steps for solving the single flower problem carried out by student 2, it can be seen in Figure 3.

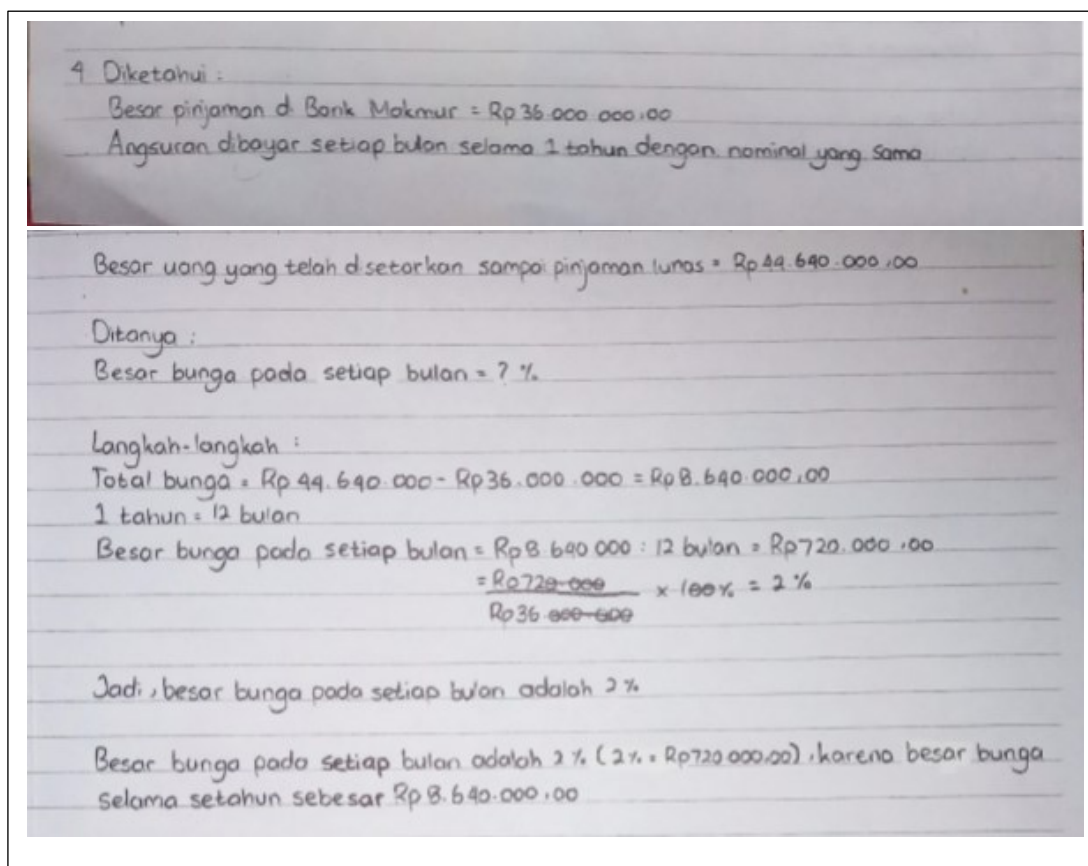


Figure 3. Problem solving steps by students 2

Student 3

At the stage of understanding the problem, student 3 is able to write down the information known and asked about from the problem completely and accurately. Student 3 writes down the information known from the question, namely the size of the loan, the installment time, and the amount of money deposited until the loan is paid off. Apart from that, student 3 wrote down the information asked for in the question, namely the percentage of interest on the loan each month. Thus, student 3 can fulfill the first indicator of critical thinking ability, namely interpretation.

At the planning stage, student 3 knows the steps in solving a problem shown through data collection activities based on existing information to find something related to solving the problem (question). Based on the information known from the question, namely the size of the loan and the amount of money deposited until the loan is paid off, new information is obtained, namely the amount of the installment without interest each month and the amount of the installment with interest each month. Furthermore, through this new information, the amount of loan interest obtained every 1 month is obtained. Thus, the 3rd student can fulfill the second indicator of critical thinking ability, namely analysis.

At the stage of implementing planning, student 3 writes down complete problem solutions and performs calculations correctly. Based on the amount of interest on the loan every

1 month that has been obtained, student 3 can determine the percentage of interest on the loan every 1 month correctly. Thus, student 3 can fulfill the third indicator of critical thinking ability, namely evaluation. Next, student 3 wrote a conclusion from the answers they had obtained, starting with the words "So,...." correctly. When writing conclusions, student 3 adds reasons for the answers given correctly. Thus, student 3 can fulfill the fourth and fifth indicators of critical thinking skills, namely inference and explanation. The inference indicator is fulfilled because student 3 can draw conclusions from the results of solving the questions correctly. Meanwhile, the explanation indicator can be fulfilled because student 3 can write down the final results along with the reasons for the answers given correctly.

At the re-checking stage, student 3 is considered to have re-checked the steps for solving the questions and the calculation results that have been written down to avoid errors. Because no errors were found from student 3 in solving the questions. In this way, student 3 can fulfill the sixth indicator of critical thinking ability, namely self-regulation. Regarding the steps for solving single flower problems that have been carried out by student 3, it can be seen in Figure 4.

diketahui : Ibu Nita meminjam modal = 36.000.000, angsuran dibayar setiap bulan 1 tahun, setelah dihitung ternyata uang yg dibayarkan sampai lunas sampai 41.640.000
ditanya : besar bunga pada setiap bulan adalah %
Jawab : bunga : $41.640.000 - 36.000.000 = \text{Rp. } 5.640.000$
Angsuran tanpa bunga : $\frac{36.000.000}{12} = 3.000.000$, angsuran + bunga = $41.640.000$

Rp 3.720.000, bunga per bulan = $3.720.000 - 3.000.000 = \text{Rp. } 720.000$
Persentase bunga per bulan = $\frac{720.000}{36.000.000} \times 100\% = 2\%$
Jadi, besar bunga pada setiap bulan adalah 2%

Figure 4. Problem solving steps by students 3

Based on the results of working on the problem solving questions above, it shows that student 1, student 2, and student 3 are able to meet the indicators of critical thinking ability. All indicators of critical thinking skills consisting of interpretation, analysis, evaluation, inference, explanation and self-regulation have been fulfilled by the three students. The three students who are in the top 3 parallel PTS rankings for the odd semester of the 2020/2021 class VII academic year from a state junior high school in Sleman district demonstrated high critical thinking skills by meeting all the indicators. This is in line with Purwati, Hobri, & Fatahillah (2016) who stated that all critical thinking indicators can be met by students with a high critical thinking ability category. Apart from that, this can prove that critical thinking skills and academic achievement are closely related (Demirci & Özyürek (2017).

Based on the results of working on the problem solving questions above, the first interesting thing to discuss from the results of this research is that the three students were able to fulfill all indicators of critical thinking ability with different problem solving processes. At the stage of understanding the problem (interpretation indicators) the three students can write

down the information they know and ask about from the question with the same points. However, there are differences at the planning stage (analysis indicators). Based on the information known from the question, namely the size of the loan and the amount of money deposited until the loan is paid off, student 1 obtains new information, namely the amount of interest on the loan every 1 year. Furthermore, through this new information, a large percentage of loan interest is obtained every 1 year. Student 2 with the same information obtained new information, namely the amount of loan interest every 1 year. Furthermore, through this new information, the amount of loan interest obtained every 1 month is obtained. Meanwhile, student 3 with the same information obtained new information, namely the amount of installments without interest each month and the amount of installments with interest each month. Furthermore, through this new information, the amount of loan interest obtained every 1 month is obtained.

Even though there are differences in the planning stage (analysis indicators), all three students were able to solve problem solving questions correctly. Based on the percentage of loan interest every 1 year that has been obtained by student 1, at the planning implementation stage (evaluation indicators) the percentage of loan interest every 1 month is obtained, namely 2%. Based on the amount of interest on the loan every 1 month that has been obtained by student 2, at the stage of implementing the planning (evaluation indicators) the percentage of interest on the loan every 1 month is obtained, namely 2%. Based on the amount of interest on the loan every 1 month that has been obtained by student 3, at the stage of implementing the planning (evaluation indicators) the percentage of interest on the loan every 1 month is obtained, namely 2%. It is true that there are differences at the planning stage (analysis indicators), but at the planning implementation stage (evaluation indicators) all three students obtained the same problem solving results with the right processes and calculations. At the stage of implementing planning (inference and explanation indicators) the three students were also able to draw conclusions and provide appropriate reasons regarding the results of solving the problem. This shows that the three students have carried out the re-checking stage (self-regulation indicators) well because no errors were found. Thus, in line with Yanti, Prahmana, & Fitriyah (2018) that critical thinking skills encourage students to be more careful in solving problems so that the right solution is obtained.

The second interesting thing to discuss from the results of this research is at the stage of implementing planning (inference and explanation indicators), namely that the three students gave exactly the same conclusions, but from these conclusions the three students added reasons for the answers given in various ways. The three students gave different reasons to each other correctly. The three students concluded that the percentage of loan interest every 1 month was 2%. Furthermore, from the conclusions given, student 1 added the reason that the monthly interest rate is 2% because the annual interest rate is 24%. Student 2 added the reason that the monthly interest rate is 2% because the annual interest rate is IDR 8,640,000.00. Meanwhile, student 3 added the reason that the interest amount each month is 2%, because 2% of the total loan amount is the interest amount each month (in rupiah). So that the inference indicator is fulfilled because students can draw conclusions from the results of solving questions correctly and the explanation indicator can be fulfilled because students write down the final results along with the reasons for the answers given correctly. In line with Ucisaputri, Nurhayati, & Pagiling (2020) that a person's ability to use mental activity in solving problems to make logical and valid conclusions is the ability to think critically. Thus, students really need critical thinking skills in solving problems (Hidayat & Sari, 2019) in order to understand a problem (Putri, Sumardani, Rahayu, & Hajizah, 2020).

CONCLUSION AND SUGGESTIONS

Critical thinking abilities in this study were assessed based on the results of solving social arithmetic problems on indicators of critical thinking abilities. The three students who are in the top 3 parallel PTS rankings for the odd semester of the 2020/2021 class VII academic year from a state junior high school in Sleman district have high critical thinking skills. Because, all indicators of critical thinking skills consisting of interpretation, analysis, evaluation, inference, explanation and self-regulation can be fulfilled by the three students in solving social arithmetic. The three students were able to fulfill all indicators of critical thinking abilities through varied problem solving processes.

There are differences at the planning stage (analysis indicators), where the steps chosen by students in solving problems are different. Differences can be shown through new information obtained from processing the information known in the question. This new information will later be needed in solving problems. However, the results of solving arithmetic problems from the three students were correct and correct. The critical thinking abilities of students in solving social arithmetic problems have been described. Thus, the description of the achievement of indicators of critical thinking skills can then be used by teachers as a reference in training students' critical thinking skills at school. Critical thinking skills must continue to be developed so that students have good problem solving abilities. Then for future researchers, it is hoped that the suggestions that can be given regarding this research can be expanded and not limited.

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