



Students' Misconceptions Of Social Arithmetic Problems

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Abstract

The purpose of this study was to determine the analysis of misconceptions of social arithmetic material in grade VII students at SMP Negeri 1 Simpang Keuramat. The research approach used in this study is a descriptive qualitative method. The research was conducted at SMP Negeri 1 Simpang Keuramat class VII. The subjects of the study were students of class VII-1 totaling 13 students. Data analysis techniques are qualitative analysis, namely data collection, data reduction, data presentation and drawing conclusions. The data collection instruments used in this study are test instruments, namely misconception tests and non-test instruments, interview guidelines. The results of the study found several misconceptions experienced by students in social arithmetic material categorized into five types, namely students who experienced concept misconceptions as many as 1 person with a percentage of 7.69%, students who experienced numeracy misconceptions as many as 2 people with a percentage of 15.3%, students who experienced systematic misconceptions as many as 6 people with a percentage of 46.1%, students who experienced misconceptions as many as 3 people with a percentage of 23%, students who experienced misconceptions of strategies were 5 people with a percentage of 38.5%.

Abstract

Tujuan penelitian ini adalah untuk mengetahui analisis miskonsepsi materi aritmatika sosial pada siswa kelas VII SMP Negeri 1 Simpang Keuramat. Pendekatan penelitian yang digunakan dalam penelitian ini adalah metode kualitatif deskriptif. Penelitian dilakukan di SMP Negeri 1 Simpang Keuramat kelas VII. Subjek penelitian adalah siswa kelas VII-1 berjumlah 13 siswa. Teknik analisis data adalah analisis kualitatif, yaitu pengumpulan data, reduksi data, penyajian data dan penarikan kesimpulan. Instrumen pengumpulan data yang digunakan dalam penelitian ini adalah instrumen uji, yaitu uji miskonsepsi dan instrumen non tes, yaitu pedoman wawancara. Hasil penelitian menemukan beberapa miskonsepsi yang dialami siswa dalam materi aritmatika sosial dikategorikan menjadi lima jenis, yaitu siswa yang mengalami miskonsepsi konsep sebanyak 1 orang dengan persentase 7,69%, siswa yang mengalami miskonsepsi numerasi sebanyak 2 orang dengan



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persentase 15,3%, siswa yang mengalami miskonsepsi sistematis sebanyak 6 orang dengan persentase 46,1%, Mahasiswa yang mengalami miskonsepsi sebanyak 3 orang dengan persentase 23%, mahasiswa yang mengalami miskonsepsi strategi sebanyak 5 orang dengan persentase 38,5%.

Introduction

Misconceptions are errors in understanding a concept, according to (Suparno: 2013) where the concept understood does not correspond to the scientific understanding or understanding accepted by experts. Meanwhile, according to Fowler and Jaoude (Sarilawati: 2011) misconception is the error of an inaccurate understanding of a concept, the incorrect use of concepts, the wrong classification of examples of chaos between different concepts, and the hierarchical relationship of concepts that are not correct. Low student learning outcomes indicate that there are still difficulties in learning social arithmetic concepts this learning difficulty is due to previous learning that does not pay attention to misconceptions.

Misconceptions that occur according to (Wilantara: 2003) in students make the concepts that students have meaningless because they cannot be connected with other concepts. Meanwhile, according to (Natalia, et al 2016) said that there are three types of Misconception in solving mathematical problems, namely: errors in concepts (*misconception*), errors in algorithms or procedures (*faulty algorithms*), and errors due to lack of accuracy (*human error*). According to (Suparno: 2013: 34) the causes of misconceptions can be broadly summarized in five groups, namely: students, teachers, textbooks, contexts, and teaching methods. As well as describing the types of misconceptions experienced by students and the factors causing misconceptions in solving mathematical problems in the material of social arithmetic operations.

Social arithmetic is a branch of mathematics that is often encountered in everyday life, especially in buying and selling activities, the purpose of studying social arithmetic is generally to know how to make the greatest profit and avoid the minimum possible loss. Social arithmetic is one of the materials studied by students because it is related to the sales price, purchase price, profits, losses, interest, discounts, taxes, Bruto, tara, and net so that it will be useful when solving the problem in the future according to (Dila, et al, 2020: 18). Although the material is important to learn, in reality there are still students who experience misconceptions in solving these problems so it is important to do research. Based on the facts that occurred at SMP Negeri 1 Simpang Keuramat, the social arithmetic material has been studied, but most of the class VII students still feel confused and cannot understand or do questions related to social arithmetic material.

Based on the research questions above, the purpose of this study is to determine the analysis of misconceptions of social arithmetic material in grade VII students at SMP Negeri 1 Simpang Keuramat.

Methods

Research Population

The population in this study was all students of SMP Negeri 1 Simpang Keuramat. The collection of research samples was carried out on grade VII-1 students at SMP Negeri 1 Simpang Keuramat. The research uses a qualitative approach with a descriptive approach.

Research Instruments

Test and non-test instruments were used in this study. The test used is a misconception test, non-test tools i.e. interview guidelines.

Research Phase

This research stage includes (a) Data Collection Techniques (providing misconception test questions to students in grades VII-1 social arithmetic concept after which 5 students with the most misconception levels are selected to be interviewed), (b) Data Reduction (focusing on students on learning mathematics social arithmetic material whose answer results refer to misconceptions), (c) Data Presentation (data presentation is carried out in the form of diagrams to make it easier for researchers to understand what occurs), (d) Drawing conclusions (providing conclusions on the results of the analysis and providing explanations from the data that have been obtained

Results and Discussion

Result

This research was carried out at SMP Negeri 1 Simpang Keuramat and was carried out directly on class VII-1 students totaling 13 students, selected students who really experienced misconception were 6 students while the research subjects interviewed were 6 students. Based on the test results of grade VII-1 students of SMP Negeri 1 Simpang Keuramat and interviews that have been conducted by researchers, data on misconceptions experienced by students in solving social arithmetic problems were obtained. In this study, forms of translation misconceptions, concept misconceptions, strategy misconceptions, systematic misconceptions, and numeracy misconceptions were used.

1. Data Misconceptions that occur in social arithmetic in terms of the test results of 6 students
 - a) In question point number 1, students are faced with the problem of understanding definitions related to social arithmetic

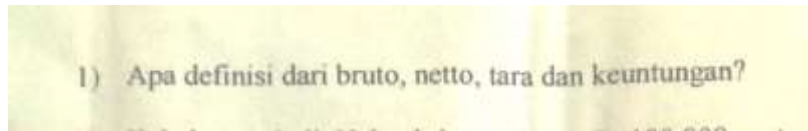


Figure 1. Item number 1

Here is the answer to S1

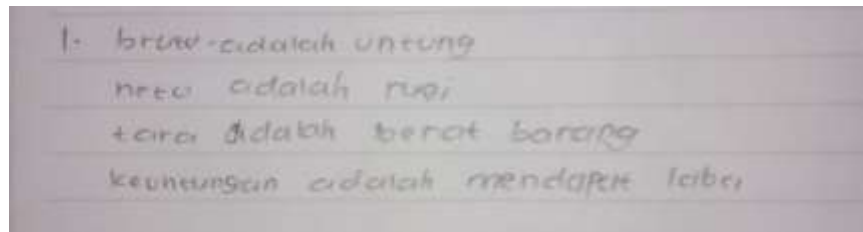


Figure 2. S1 answer number 1

Researcher : what do you understand about the definition of gross, net, tare and profit?

Student1 : what I understand gross is profit, net is loss, tare is the weight of the goods, and profit is profit

Researcher : why is your answer gross is profit, net is loss, and tara is the weight of the goods while profit is profit?

Student1 : yes buk as far as I know, gross is profit, net is loss, tara is the weight of the goods and the profit of making a profit is so buk as far as I know.

Based on the results of the analysis of misconceptions experienced by grade VII-1 students at SMP Negeri 1 Simpang Keuramat, it was found that from the results of student work, misconceptions were found in doing questions related to the definition of social arithmetic. The misconceptions that appear in the results of student work are further categorized based on material related to the misconceptions experienced by students. (Student1) does not understand the definition of social arithmetic material, namely the definition of gross, net, tare, and profit, the student answers that the definition of gross is profit, net is loss, tara is the weight of goods, profit is profit, the answer includes misconceptions of concepts because the student does not understand the concept well and correctly in defining gross, net, tara, and profit. It should be in the answer that gross is the gross weight of the goods plus the weight of the wrapping of the goods, the tara is the additional weight in the form of a box or wrapper (the difference between gross weight and net weight), net is the weight for the goods only (net weight) while the profit is obtained if the sales price is greater than the purchase price.

- b) In question item number 2, students are faced with the problem of determining the selling price

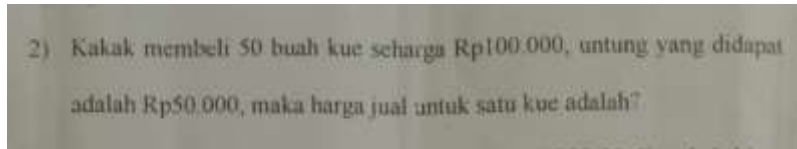


Figure 3. Item question number 2

Here is the answer to S1

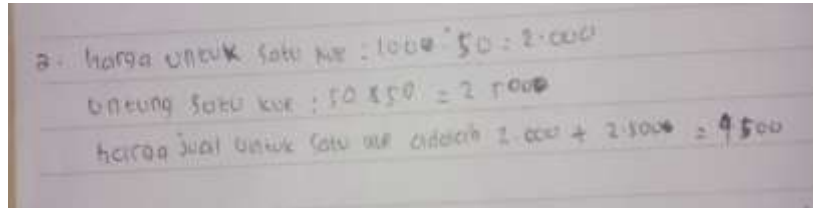


Figure 4. S1 answer number 2

Researcher : ok well then we continue number 2, can you determine the calculation operation in mathematics used to solve the problem?

Student1 : yes of course ma'am, the calculation operation I use for the price of one cake $100:50=2,000$, if the profit for one cake is $50 \times 50 = 2,500$ well if the selling price for one cake is $2,000 + 2,500 = 4,500$

Researcher : how do you know that the calculation operation in mathematics is the one used when solving the problem?

Student1 : it's like that, mom, as far as I know, it's like that, the price for one cake is $100:50=2,000$ profit for one cake $50 \times 50 = 2,500$, the selling price for one cake is $2,000 + 2,500 = 4,500$

In addition, based on the results of the analysis of student misconceptions, it was also found that the results of student work experienced misconceptions in doing questions related to determining selling prices in social arithmetic. The misconceptions that appear in the results of student work are further categorized based on material related to the misconceptions experienced by students. (Student1) made a mistake in the mathematical calculation operation, the student answered the price for one cake: $100:50 = 2,000$ profit for one cake: $50 \times 50 = 2,500$ the selling price for one cake is $2,000 + 2,500 = 4,500$, the answer includes a misconception of the calculation because there is an error in the calculation, namely in the calculation of determining the price for one cake, determining the profit for one cake, because the calculation of the price for one cake and the profit for one cake has an error, then to determine the selling price for one cake also has an error, the correct calculation should be

Determining the price for one cake = $\text{Rp}100.000:50 = \text{Rp}2.000$

Determining the profit for one cake = $\text{IDR } 50,000:50 = \text{IDR } 1,000$

Then the selling price for one cake is $\text{IDR } 2,000 + 1,000 = \text{IDR } 3,000$

Here is the answer to S2

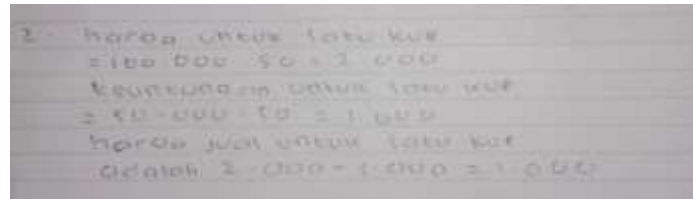


Figure 5. S2 answer number 2

Researcher : for number 2, can you determine the calculation operation in mathematics used to solve the problem?

Student2 : yes, mom, to calculate the price of one cake, I use the division which is $100,000:50=2,000$ to calculate the profit for one cake, which is to use the division also which is $50,000:50=1,000$ now if to calculate the selling price for one cake I use a reduction of $2,000-1,000=1,000$.

Researcher : how do you know that the calculation operation in mathematics is the one used when solving the problem?

Student2 : yes mom, as far as I know it is like that the price for one cake is reduced with the profit for one new cake can be the result which is 1,000 so buk as far as I know

Furthermore, based on the results of the misconception analysis experienced by class VII-1 students, it was found that the results of student work found misconceptions in doing social arithmetic questions regarding the determination of selling prices, misconceptions that appeared in the results of student work were further categorized based on material related to misconceptions experienced by students. (Student2) made a mistake in the mathematical calculation operation, the student answered the price for one cake $100,000:50 = 2,000$ profit for one cake $50,000 \times 50 = 1,000$ the selling price for one cake is $2,000-1,000 = 1,000$, the answer includes a misconception of the calculation because there is an error in the calculation, namely in the calculation section to determine the selling price for one cake.

c) In question item number 3, students are faced with the problem of percentage loss

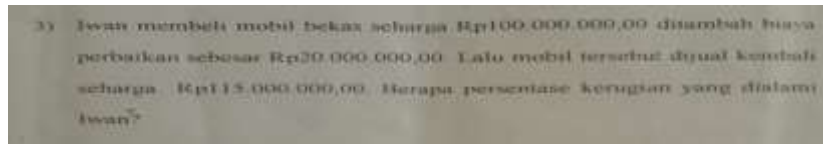


Figure 6. Item question number 3

Here are the S3 answers

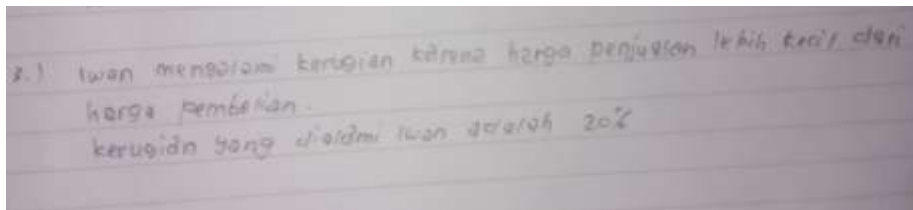


Figure 7. S3 answer number 3

Researcher : for number 3, what do you understand from the question question?

Student3 : what percentage of losses are suffered by iwan

Researcher : ok, how do you determine the formula for the question until you get the answer?

Student3 : I use the mom loss percentage formula, that's why the loss suffered by Iwan is 20%

Researcher : from your answer from where to do first to get the answer?

Student3 : determine the value of the loss first how much it is used up and then it is concentrated, as far as I know it is like that buk after that just get the result what percentage.

Furthermore, based on the results of the misconception analysis experienced by class VII-1 students, it was found that from the results of student work, misconceptions were found in doing questions regarding the percentage of losses in social arithmetic material, misconceptions that appeared in the results of student work were further categorized based on material related to misconceptions experienced by students. (Student3) cannot determine the formula or other problem solving alternatives to solve the given problem, students also experience errors / incompleteness in writing down the steps to solve the problem, students answer iwan suffered a loss because the sales price was smaller than the purchase price, the loss suffered by iwan was 20%. The answer includes a misconception of the strategy due to the student's inability to determine the right mathematical strategy to use to solve the problem. And including systematic misconceptions because they do not use steps or are still incomplete and less detailed to solve social arithmetic problems. The right

steps and strategies to solve the problem should be

Known : Purchase price = Rp100.000.000,00 + Rp20.000.000,00 =120.000.000,00

Sales price = 115,000,000.00

Asked : Percentage of losses suffered by iwan?

Settlement:

Because the sales price is smaller than the purchase price, iwan suffers losses, the magnitude of which:

Loss value = Rp120.000.000,00 - Rp115.000.000,00

Loss percentage: $\% Loss = \frac{Rp.5.000.000}{Rp\ 120.000.000} \times 100\% = \frac{1}{24} \times 100\% = 4,71\%$

Here is the answer to S4

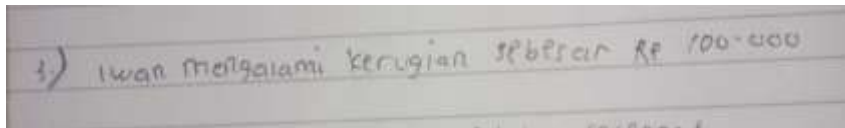


Figure 8. S4 answer number 3

Researcher : what do you understand from the question question?

Subject4 : what percentage of losses are incurred by Iwan

Researcher : how do you determine the formula for the problem until you get the result?

Student4 : because what is asked about the percentage loss so the formula used is the formula %loss buk

Researcher : well, from your answer from where to do first to get the answer?

Student4 : the first one that determines the value of the loss suffered by iwan

Researcher : is that what is done first to get the answer?

Student4 : yes, that buk, which I know is that it is a loss suffered by Iwan of Rp. 100,000

Researcher : ooh like that? So there's no need to take steps first to determine the answer?

Student4 : no buk, which I know as such, the important thing is that we know he has a loss or not

In addition, based on the results of the misconception analysis experienced by class VII-1 students, it was found that the results of student work found several

misconceptions in doing questions regarding the percentage of losses in social arithmetic material, misconceptions that appeared in the results of student work were further categorized based on material related to misconceptions experienced by students. (Student4) experienced errors / incompleteness in completing the steps to solve the given problem and could not determine the formula or alternative solution to other problems to solve the given problem, the student replied that Iwan suffered a loss of Rp. 100,000. The answer included systematic misconceptions because the student experienced errors or was incomplete in writing down the steps to solve the problem. And including misconceptions of strategy, due to the inability of students to determine the appropriate mathematical strategies to use to solve social arithmetic problems.

- d) In question item number 4, students are faced with the problem of the amount of interest received and the length of savings

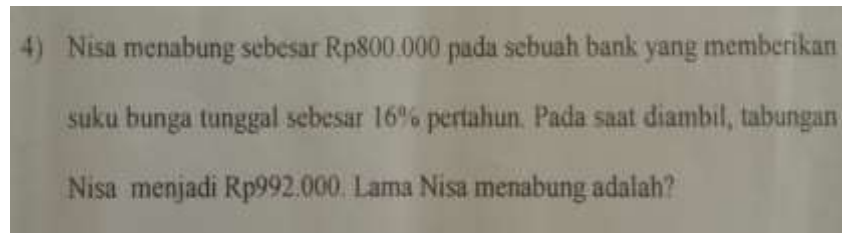


Figure 9. tem question number 4

Here is the answer to S1

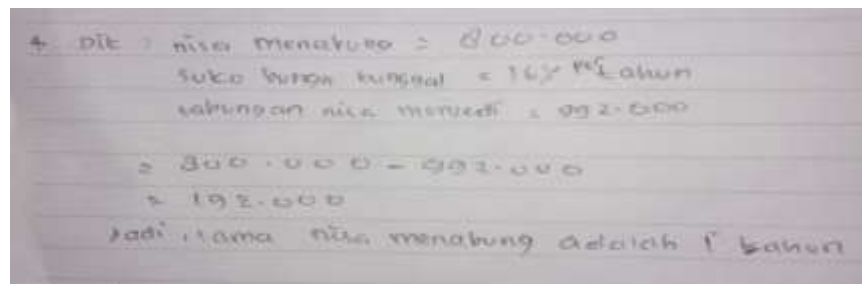


Figure 10. Answer S1 number 4

Researcher : for number 4, what do you understand from the question question?

Student1 : who is asked at number 4 which I understand how long does Nisa save?

Researcher : From your answer, where to do it first to get the answer?

Student1 : what needs to be done first is to make it known first buk, such as dik:Nisa saves = 800,000 single interest rate = 16% per year Nisa's savings become = 992,000 after that the completion is booklet: $800,000 - 992,000 = 192,000$ so the length of time Nisa saves is 1 year

Researcher : Do you think your answer is complete in writing down the steps?

Student1 : yes as far as I know my answer is very complete buk because at first I made it known first.

Based on the results of the misconception analysis experienced by class VII-1 students, it was found that from the results of student work, misconceptions were found in doing questions regarding the amount of interest received and the length of savings, misconceptions that appeared in the results of student work were further categorized based on material related to misconceptions experienced by students. (Student1) unable to solve the given social arithmetic problem or encountered errors or incomplete in writing down the steps, the student replied Dik: nisa saving = 800,000 single interest rate = 16% per year nisa savings to = 992,000, $800,000 - 992,000 = 192,000$ so the length of nisa saving is 1 year. The answer includes systematic misconceptions because it is not appropriate because the steps to solve the problem are still incomplete and less detailed, the steps that should be

Known : Initial savings : Rp 800.000

Single bungan : 16% per annum

Final savings : IDR 992,000

Asked : the length of time Nisa saves is?

Settlement:

Calculating the amount of monthly interest to receive:

$$\begin{aligned} &= \frac{16}{100} \times 800.000 \times \frac{1}{12} = \frac{16}{100} \times 800.000 \times \frac{1}{12} \\ &= \frac{128.000}{12} = \frac{64.000}{6} \end{aligned}$$

Total amount/amount of interest received

$$= 992.000 - 800.000$$

$$= 192.000$$

So, the length of time Nisa saved is

$$\begin{aligned} &= \frac{\text{bunga yang diperoleh}}{\text{bunga per bulan}} \\ &= 192.000 : \frac{64.000}{6} = 18 \text{ months} \end{aligned}$$

Here are the S3 answers

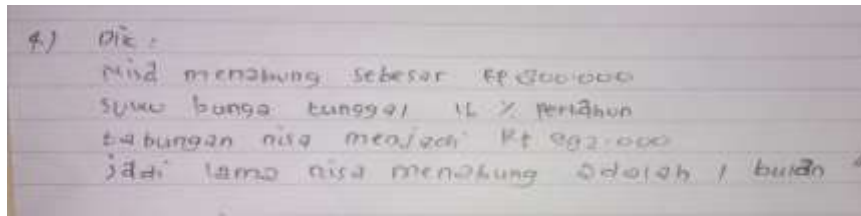


Figure 11. S3 answer number 4

Researcher : for number 4 what formula do you use to do the problem?

Student3 : the formula I use is initial savings- end savings

Researcher : from your answer where to start first to get the answer?

Student3 : initially dbukat was known first as dik:Nisa saved Rp800,000 single interest rate 16% per year nisa savings to Rp992,000 so as far as I know buk after that just got the answer at the end, namely so the length of time nisa saving is 1 month

In addition, based on the results of the misconception analysis experienced by class VII-1 students, it was found that from the results of student work, misconceptions were found in doing questions regarding the amount of interest received and the length of savings, misconceptions that appeared in the results of student work were further categorized based on material related to misconceptions experienced by students. (Student3) unable to determine the formula or other alternative solutions to solve the given problem, students also experienced errors / incompleteness in writing down the steps to solve the problem, the student replied Dik: Nisa saves Rp800,000 single interest rate of 16% per year nisa savings to Rp992,000 so the length of nisa saving is 1 month. These answers are systematic misconceptions because they are still not correct because the steps are still incomplete and detailed and still have formulas. And including the misconception of strategies due to the inability of students to determine formulas or other problem-solving alternatives used to solve a given arithmetic problem.

Here is the answer to S4

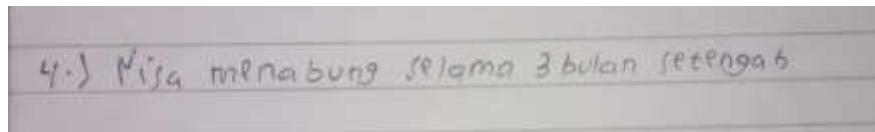


Figure 12. S4 answer number 4

Researcher : ok, let's continue number 4, yes, for number 4 if you use simple language, are you easy to understand?

Student4 : yes buk inshaallah may be easier

Researcher : well then, what formula do you use to solve the problem?

Student4 : the formula is early savings-end savings: single interest

Researcher : that formula is what you use for number 4? But why didn't you answer the formula?

Student4 : yes, as far as I know, the formula is used for number 4, I look for the answer on the paper doodling buk, the final result is just on the answer paper

Furthermore, based on the results of the misconception analysis experienced by class VII-1 students, it was found that from the results of student work, misconceptions were found in doing questions regarding the amount of interest received and the length of savings, misconceptions that appeared in the results of student work were further categorized based on material related to misconceptions experienced by students. (Student4) is unable to understand the words on social arithmetic problems to be converted into mathematical models or mathematical sentences correctly, and also students cannot determine the formula for solving the problem and students experience errors/incompleteness in writing down the steps to solve the problem. Students replied Nisa saved for 3 months and a half. The answer includes translation misconceptions because students do not understand how to present the things known from the questions properly and correctly. And including systemic misconceptions because the answer is still not quite right, the completion step is still incomplete and still lacks a formula. As well as including misconceptions of strategies due to the inability of students to determine the right mathematical strategies to use to solve these arithmetic problems.

Discussion

Based on the results of the analysis of misconceptions experienced by grade VII-1 students at SMP Negeri 1 Simpang Keuramat. The discussion of the results of research that has been carried out using the interview method and test documentation of students who experienced misconceptions, namely 6 students, is as follows

1. Understand definitions related to social arithmetic

This indicator consists of 1 question item, namely question number 1. In question number 1, not all students answered and for students who answered incorrectly as many as 6 students who experienced concept misconceptions as many as 1 student so that the percentage of students who experienced concept misconceptions was 7.69%.

2. Errors in the count operation

This indicator consists of 1 question item, namely question number 2. In question number 2, not all students answered incorrectly and for students who answered wrong

counting numbered 6 students who experienced misconceptions counting as many as 2 students, the percentage was 15.3%.

3. Incomplete in writing down the steps to solve the problem

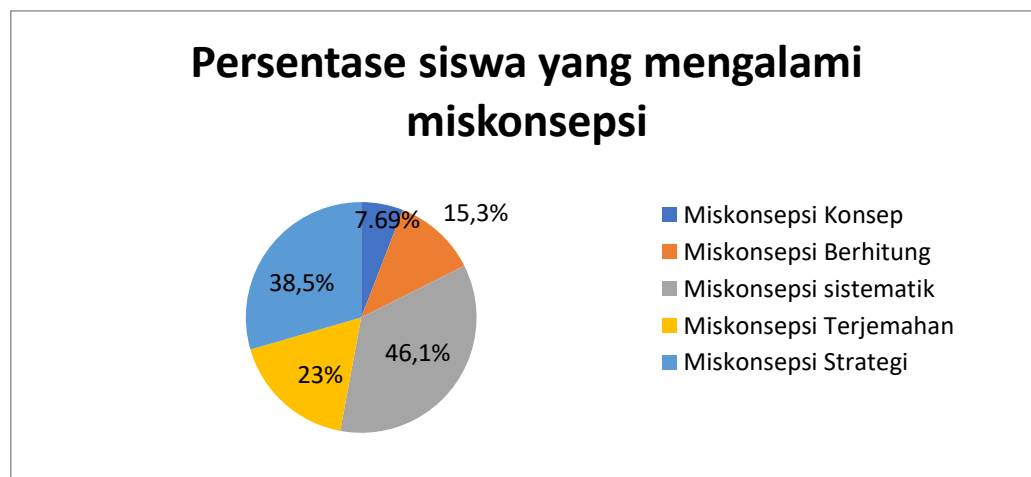
This indicator consists of 3 questions, namely in questions number 3, 4, and 5 students who answered incorrectly as many as 6 students as well as students who experienced systematic misconceptions, namely 6 students as well, the percentage was 46.1%.

4. Unable to understand words in social arithmetic problems to be converted into mathematical models or sentences correctly

This indicator is found from 2 question items, namely questions number 4 and 5. In question number 4 and 5, not all students answered incorrectly and for students who answered wrongly identified translation misconceptions because the number of students who experienced misconceptions was 6 students as well as students who experienced translation misconceptions, namely 3 students, the percentage was 23%.

5. Determining formulas used to solve social arithmetic problems

This indicator is found from 3 question points, namely questions number 3, 4 and 5. In question number 3, 4 and 5, not all students answered incorrectly and for students who answered wrongly identified misconceptions of strategies because the number of students who experienced misconceptions was 6 students as well as students who experienced misconceptions of strategies, namely 5 students, the percentage was 38.5%.



Conclusion

Based on the results of research and discussion, it can be concluded about the misconceptions experienced by students in social arithmetic as for the forms of misconceptions and the percentage of each form of misconception as follows:

1. Misconception of concepts is the error or inability of students to understand definitions related to social arithmetic, while the percentage of concept misconceptions is 7.69%
2. Misconceptions of Numeracy is the error or inability of students to perform counting operations in mathematics such as summing, subtracting, dividing and multiplying, while obtaining the percentage of misconceptions in counting, which is 15.3%
3. Systematic misconceptions, namely students experience errors or are incomplete and unsystematically write down the steps to solve social arithmetic problems properly and correctly, while the percentage of systematic misconceptions is 46.1%
4. Translation Misconception is the inability of students to understand words in social arithmetic problems to change what is known in the problem into mathematical models or mathematical sentences properly and correctly, while obtaining the percentage of translation misconceptions, which is 23%
5. Strategy Misconception is the inability of students to determine formulas or alternatives to solving other problems used to solve or do social arithmetic problems, while obtaining a percentage of strategy misconceptions is 38.5%

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