



Analysis of Students' Misconceptions in Addition and Subtraction Material

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Abstract. Backgrounds: Understanding mathematical concepts is significant and influences students in working on various problems. Understanding the picture is the basis that needs to be achieved to make it easier for students to proceed to the next level of understanding. When students understand a concept, they will be able to remember the Mathematics lessons they have learned in the long term. Understanding the wrong concept can lead to misconceptions in students. Fantasies that are not immediately corrected can result in low student learning outcomes. Methods: This study used a qualitative approach. The subjects in this study were six grade 1 student at SDN Soko 2, Indonesia. The data collection techniques in this study were observation, tests, and interviews. Data analysis was data reduction, data presentation, and conclusion. The validity of the data was done by triangulation of sources and techniques. Results: The results of this study were six students of SDN Soko 2 experiencing frequent misconceptions, calculation misconceptions, and language misconceptions. Students with high mathematical ability experience the most minor misconceptions: calculation misconceptions. Students with mathematical abilities are experiencing two misconceptions, namely calculation, and systematics. Students with low mathematical ability experience the most misconceptions, namely systematic, Mathematics, and language misconceptions. Implications: Teachers are expected to be more creative in developing engaging learning for students to reduce the occurrence of misconceptions and motivate students to be enthusiastic about participating in education. For students to study harder and not be lazy, and for parents to always pay attention and guide their children when looking at a home.

Novelty: This study revealed several types of misconceptions that occur in grade 1 students of SDN Soko 2 based on the level of students' mathematical abilities.

Keywords: misconception · sum · subtraction · addition

1 Introduction

Learning is a system consisting of several components, which between the members are interrelated or related to achieving educational goals [1]. In learning, students are required to understand various subjects well, one of which is in learning Mathematics. Mathematics consists of multiple concepts that are arranged hierarchically, so understanding mathematical concepts is an essential part of the learning process [2].

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Understanding the concept is one of the skills or abilities to understand and explain a situation or action of a class or category, which has general properties that are known in Mathematics [3]. Understanding the concept is very important in the teaching and learning process or the Mathematics learning process because Mathematics has properties that are interrelated with each other [4]. Understanding mathematical concepts are fundamental and influence students in working on various problems. Understanding the concept is the basis that needs to be achieved to make it easier for students to proceed to the next level of understanding. When students understand a concept, they will be able to remember the math lessons they have learned in the long term. A good understanding of students' mathematical concepts will bring up students' critical thinking patterns. Students are also expected to be able to restate their work either orally or in writing to other people or their peers so that students and their peers can understand it. Understanding the wrong concept can lead to misconceptions.

Misconceptions are seen as an inaccurate understanding of concepts, use of wrong concepts, wrong classification of examples, confusion of different concepts, and hierarchical relationships of incorrect concepts [5]. The causes of misconceptions are divided into five leading causes: students, teachers, textbooks, context, and teaching methods [6]. The causes of misconceptions experienced by students can come from the students themselves, which are related to the initial knowledge possessed by students (preconceptions), stages of cognitive development that are not following the concepts being studied, students' reasoning being limited and wrong, students' ability to capture and understand the concepts being studied, and student's interest in learning the concepts being taught. Apart from the student factor, misconceptions are influenced by several other things, such as the teacher and the learning carried out, teaching materials, and teachers who do not master the appropriate learning approaches and methods used to convey the material. In addition, what causes conceptual errors in learning Mathematics is that the teacher does not master the core material given. [5]. According to [8], student learning outcomes can be used to illustrate how much knowledge students can master after the learning process takes place. According to [9], the misconceptions that occur in students consist of several forms, namely, notational misconceptions, generalizing misconceptions, and calculation misconceptions. Notational misconceptions are errors in using symbols, such as ignoring a sign. The generalization misconception is a conceptual error in understanding the addition of fractions, such as assuming that adding two fractional numbers is to add up the numerators and add up the denominators. The misconception of calculation is an inaccurate understanding of the concept of calculation and the use of incorrect calculation concepts, such as errors in adding up.

2 Method

2.1 Type and Design

In this study, the authors used a qualitative type of research. According to [10], qualitative research is a study used to examine natural objects where the author is the key instrument, data collection techniques are combined, data analysis is inductive, and qualitative

research results emphasize meaning rather than generalization. The author uses qualitative research because, in this study, the author wants to describe some misconceptions that occur in students.

2.2 Data and Data Sources

The data source is the subject from which the data can be obtained. Interviews with sources can get data, observations in the form of objects, motions, or processes of something, and documentation. In this study, primary data was obtained from the results of tests and interviews conducted with six elementary school students with high, medium, and low levels of mathematical ability.

2.3 Data Collection Technique

Observation

Observation or observation is defined as systematic observation and recording of an object of research. In this study, the author is directly involved in the observed activities. In this direct observation, the author acts as a full observer who can observe the symptoms or processes that occur in actual situations. This observation was conducted to obtain data regarding the occurrence of mathematical misconceptions in grade 1 students at SDN Soko 2.

Interview

In addition to observation, authors also used interview techniques in collecting data. In this study, the authors interviewed 6 grade 1 student at SDN Soko 2 to obtain the necessary data regarding misconceptions in Mathematics learning.

Test

In addition to observations and interviews in this study, authors used tests to collect data. The test was given to 6 students of SDN Soko 2 to get data about the misconceptions that occurred.

2.4 Data Validity

Test the validity of the data carried out in this study used the triangulation technique. Triangulation is checking data from various sources in various ways and multiple times. The data validity test was carried out using source and technical triangulation techniques. Triangulation of seeds was used to check data about its validity and compare the results of interviews with the contents of a document by utilizing various sources of information data as consideration and using different techniques to obtained data from the same source.

2.5 Data Analysis

The data analysis used by the authors in this study is the analysis of the Miles Huberman model. The analysis technique used were data reduction, data presentation, and conclusion.

3 Result and Discussion

3.1 Result

This study was conducted by gave tests to 6 grade 1 student of SDN Soko 2, namely 2 students with high mathematical ability, 2 students with moderate mathematical knowledge, and 2 with low mathematical ability. Based on the results of tests and interviews conducted with the 6 students, all students experienced several types of misconceptions, including frequent, arithmetical, and language misunderstandings (Table 1).

Subject 1 (S1)

From the results of the tests, S1, with a high level of mathematical ability, has misconceptions. Of the 5 questions that have been done, S1 has a fantasy on question number 4. The following are the results of tests and interviews with S1 (Fig. 1).

P : “Do you think question number 4 is difficult?”

S1 : “Not.”

P : “Then do you think your answer is correct?”

S1 : “Yes.”

P : “Trycounted again.”

Based on the answers to the results of tests and interviews conducted with S1, it shows that S1 has a calculation misconception in question number 4. S1 has a calculation misconception, with the indicator being able to solve the problem according to the correct steps but wrong in determining the results. This can be seen from the answers of students who wrote down the results $36 - 12 = 23$. Judging from the results of the interviews, it was shown that S1 was less careful in performing the arithmetic addition operation, so the results were incorrect.

Table 1. Student List

No.	Name	Mathematics Ability Level
1.	S (S1)	High
2.	S. A (S2)	High
3.	A (S3)	Currently
4.	T (S4)	Currently
5.	M. A (S5)	Low
6.	A. H (S6)	Low

Direct Translation:

4. Mrs. Mira buys 36 kg of oranges at the market. Then give it to Mrs. Sri as much as 12 kg. So how many oranges do Mrs. Mira have left?

$$36 - 12 = 23$$

Fig. 1. Misconceptions of S1

4. Bu Mira membeli jeruk di pasar sebanyak 36 kg. Lalu memberikan pada Bu Sri sebanyak 12 kg. Jadi masih berapa sisa Jeruk yang dimiliki Bu Mira?

$$36 - 12 = 12$$

Direct Translation:

4. Mrs. Mira buys 36 kg of oranges at the market. Then give it to Mrs. Sri as much as 12 kg. So how many oranges do Mrs. Mira have left?

$$36 - 12 = 12$$

Fig. 2. Misconceptions of S1

Subject 2 (S2)

The results of the tests carried out by S2 showed that S2 had misconceptions. Of the 5 questions that were worked on, S2 had a fantasy on question 4. The following are the results of tests and interviews conducted with S2 (Fig. 2).

P : "Do you think question number 4 is difficult?"

S2 : "(smile)"

P : "Why is the answer 12?"

S2 : "(silence)just"

P : "TryLook again; Mrs. Mira has how many kilograms of oranges?"

S2 : "Thirty-six"

P : "Continuehow many kilograms was given to Mrs. Sri?"

S2 : "Twelve"

P : "If given meaning?"

S2 : "minus"

P : "so $36 - 12 =$ how much? Try to calculate the correct one again.

The results of the tests that were carried out showed that S2 had a misconception of calculation, with indicators that students were able to solve problems with the correct procedure but were wrong in doing calculations. This can be seen from the tests carried out; S2 wrote $36 - 12 = 12$. From the results of the interviews, S2 understood the intent and steps in working on subtraction problems but was wrong in determining the results. S2 is not careful in calculations, so the final results are incorrect.

Subject 3 (S3)

The results of tests and interviews conducted with S3 show that S3 has misconceptions. Of the 5 questions S3 did, there were misconceptions in questions 2 and 4. The following are the results of tests and interviews with S3 (Fig. 3).

Results of interviews with S3.

P : "Do you understand what is meant by question number 2?"

S3 : "(nod)"

P : "how do you do it?"

S3 : "umm,, (quiet)"

2. Doni mempunyai 9 permen, lalu ayah membelikan lagi 8 permen, dan paman memberi Doni 7 permen lagi. Jadi berapakah jumlah permen yang dimiliki Doni?

$$9 + 8 = 17$$

Direct Translation:

2. Doni has 9 candies, then dad buys 8 more candies, and uncle gives Doni 7 more candies. So how many candies does Doni have?

$$9 + 8 = 17$$

Fig. 3. Misconceptions of S3

P: "Like this, Doni has 9 candies, and Dad buys 8. How much more will Uncle give? Have a look."

S3: "seven"

P: "means? Plus, no?"

S3: "(nods)"

P: "nahh, try to count now."

The test results and interviews with S3 on number questions show that S3 has a frequent misconception. The interview results showed that S3 knew the steps in working on the problem but was wrong in understanding a concept, with indicators that students experienced errors and were incomplete in writing down the steps in solving problems (Fig. 4).

Results of interviews with S3.

P: "Are you sure that answer number 4 is correct?"

S3: "no know."

P: "How can you answer 2?"

S3: "(silence)"

From the results of the tests carried out by S3 on question number 4, it can be seen that S3 experienced a calculation misconception, with indicators that students could work on the questions with the proper steps but were wrong in determining the results.

4. Bu Mira membeli jeruk di pasar sebanyak 36 kg. Lalu memberikan pada Bu Sri sebanyak 12 kg. Jadi masih berapa sisa Jeruk yang dimiliki Bu Mira?

$$36 - 12 = 2$$

Direct Translate:

4. Mrs. Mira buys 36 kg of oranges at the market. Then give it to Mrs. Sri as much as 12 kg. So how many oranges do Mrs. Mira have left?

$$36 - 12 = 2$$

Fig. 4. Misconceptions of S3

This can be seen from the results, namely $36 - 12 = 2$. From the interviews conducted, it was shown that S3 was not able to do the calculations correctly, so the results obtained were not correct.

Subject 4 (S4)

The results of the tests that have been carried out show that S4 with mathematical abilities are experiencing misconceptions. Of the 5 questions S4 did, there was a misconception in questions 4 and 5. The following are the results of tests and interviews with S4 (Fig. 5).

The results of interview question number 4.

P : "Do you understand what number 4 means?"

S4 : "Hehehe"

P : "This why is the answer 1?"

S4 : "Do not know."

From the results of the tests carried out by S4, there was a misconception of calculation with the indicator that students were wrong in doing calculations. This can be seen from the results of students' answers who wrote $36 - 12 = 1$. From the interviews, it can be seen that S4 has been able to write down the steps with the correct completion procedure but cannot perform the arithmetic subtraction operation correctly, so it does not get the right results (Fig. 6).

4. Bu Mira membeli jeruk di pasar sebanyak 36 kg. Lalu memberikan pada Bu Sri sebanyak 12 kg. Jadi masih berapa sisa Jeruk yang dimiliki Bu Mira?

$$36 - 12 = 1$$

Direct Translate:

4. Mrs. Mira buys 36 kg of oranges at the market. Then give it to Mrs. Sri as much as 12 kg. So how many oranges do Mrs. Mira have left?

$$36 - 12 = 1$$

Fig. 5. Misconceptions of S4

5. Pada hari minggu Rara sedang bermain di taman. Lalu datang penjual roti, dan Rara membeli 8 roti. Sampai di rumah Rara memakan 2 roti miliknya, lalu memberikan 2 roti juga kepada adiknya. Jadi berapa jumlah roti yang masih dimiliki Rara?

$$8 - 4 = 4$$

Direct Translate:

5. On Sunday Rara was playing in the garden. Then came the baker, and Rara bought 8 loaves of bread. Arriving at Rara's house, she ate her 2 loaves of bread, then gave 2 of them to her sister as well. So how many loaves does Rara still have?

$$8 - 4 = 4$$

Fig. 6. Misconceptions of S4

The results of interview question number 5.

P : "Do you understand the meaning of the number 5?"

S4 : "yes"

P : "This where did you get 4 from?"

S4 : "It's 2" this is 2 (pointing to the question)"

P : "mean plus?"

S4 : "(nod)"

From the results of the tests carried out, it can be seen that S4 has a frequent misconception. Judging from the results, S4 wrote $8 - 4 = 4$. The interviews showed that S4 understood the question's meaning, but the steps were not quite right in writing.

Subject 5 (S5)

From the results of the tests conducted by S5 with low mathematical abilities, they experienced several misconceptions. Of the 5 questions S5 did, there was a misconception in questions 3, 4, and 5. The following are the results of tests and interviews with S5 (Fig. 7).

The results of interview question number 3

P : "From About story number 3, do you understand what it means?"

S5 : "(silence)just"

P : "Why can this be added?"

S5 : "(smile)"

From the results of the tests carried out, it can be seen that S5 experienced language misconceptions and calculation misconceptions. The test results show that S5 adds up the numbers even though the question is a matter of counting subtraction operations. This indicates that S5 does not understand the meaning of the story questions, so it is wrong to write down the steps in solving the problem, which causes errors in calculations (Fig. 8).

Results of interviews with S5

P : "How about question number 4?"

S5 : "(shaking)".

3. Ada 20 anak yang sedang berkumpul di lapangan. Mereka sedang bermain bola. Di tengah permainan ada 4 anak yang keluar dari lapangan dan meninggalkan permainan. Jadi ada berapa anak yang masih bermain bola di lapangan?

$$20 + 4 = 24$$

Direct Translation:

3. There are 30 children gathered in the field. They are playing football. In the middle of the game there are 4 children who leave the field and leave the game. So how many children are still playing ball in the field?

$$20 + 4 = 24$$

Fig. 7. Misconceptions of S5

4. Bu Mira membeli jeruk di pasar sebanyak 36 kg. Laju memberikan pada Bu Sri sebanyak 12 kg. Jadi masih berapa sisa Jeruk yang dimiliki Bu Mira?

3

Direct Translation:
 4. Mrs. Mira buys 36 kg of oranges at the market. Then give it to Mrs. Sri as much as 12 kg. So how many oranges do Mrs. Mira have left?
 3

Fig. 8. Misconceptions of S5

P : "This why 3?"

S5 : "(silence)"

The results of the tests showed that S5 experienced language misconceptions with indicators that students were unable to understand the meaning of the commands in the questions. From the interviews, it can be seen that S5 did not realize what has instructed in the story questions, so he answered naturally.

Results of interviews with S5

P : "Do you think question number 5 is difficult?"

S3 : "yes"

P : "Why is it so difficult?"

S3 : "because I don't know hehe"

P : "Do you understand what that means?"

S3 : "umm, (shrugs)"

The results of the tests showed that S5 had misconceptions about question number 5. Judging from the effects of the interviews conducted, S5 experienced language misconceptions. Language misconceptions occur with the S5 indicator's inability to understand the meaning of the command sentences in the questions. S5 could not understand the importance of the story questions, so he could not solve the questions according to the correct steps.

Subject 6 (S6)

From the results of the tests conducted by S6 with low mathematical abilities, they experienced several misconceptions. Of the 5 questions done, S5 shared fantasies on all the questions worked on. The following are the results of tests and interviews with S5 (Fig. 9).

Results of interviews with S6

P : "This number 1; why is the answer 7?"

S6 : "Plus"

P : "If number 2 is the same?"

S6 : "Nod"

P : "Why not write it down first?"

S6 : "(silence)just"

From the results of the tests carried out on questions number 1 and 2, it can be seen that S6 experienced systematic misconceptions with indicators experiencing errors and

1. Ana memiliki 4 pensil, lalu ibu membelikan lagi 3 pensil. *Jadi ada berapakah pensil Ana sekarang?* 7
2. Doni mempunyai 9 permen, lalu ayah membelikan lagi 8 permen, dan paman memberi Doni 7 permen lagi. *Jadi berapakah jumlah permen yang dimiliki Doni?* 24

Direct Translation:

1. Ana has 4 pencils, then mother buys 3 more pencils. So how many pencils do you have now?

7

2. Doni has 9 candies, then dad buys 8 more candies, and uncle gives Doni 7 more candies. So how many candies does Doni have?

24

Fig. 9. Misconceptions of S6

incomplete writing of steps in solving queries. This can be seen from the results that were done. Namely, the results were added up correctly, but S6 immediately added the numbers in the questions without writing them down with the correct procedures and steps (Fig. 10).

Results of interviews with S6.

P : "This number 3; what is the answer?"

S6 : "(Silencejust)"

P : "12what 22?"

S6 : "Twelve"

3. Ada 20 anak yang sedang berkumpul di lapangan. Mereka sedang bermain bola. Di tengah permainan ada 4 anak yang keluar dari lapangan dan meninggalkan permainan. *Jadi ada berapa anak yang masih bermain bola di lapangan?* 12

Direct Translation:

3. There are 30 children gathered in the field. They are playing football. In the middle of the game there are 4 children who leave the field and leave the game. So how many children are still playing ball in the field?

12

Fig. 10. Misconceptions of S6

P : "The one who plays ball" how many children are there? Take a look at it."

S6 : "Twenty"

P : "Which out how much?"

S6 : "Four"

P : "Does that mean if you go out, add or subtract?"

S6 : "Minus"

P : "So $20 - 4 =$ how many?"

S6 : "(Silencejust)"

From the results of the tests, S6 experienced frequent calculation misconceptions with indicators knowing the steps carried out in arithmetic operations but wrong in understanding concepts and determining outcomes. From the interview results, it can be seen that S6 does not understand the idea of calculating subtraction operations, so it is wrong to decide on the correct effects.

Results of interviews with S6.

P : "Numbers 4 and 5, why are not answered?"

S6 : "(silence)"

P : "Do you understand what this story means?"

S6 : "(shaking)"

From the results of the interview with S6, it was shown that S6 had language misconceptions. It can be seen from the discussion results that S6 does not understand the meaning of the command sentence of the story question so he cannot solve the problem according to the procedure and cannot determine the correct result.

4 Discussion

Based on the results of tests and interviews conducted on 6 students of SDN Soko 2, all of them experienced different misconceptions. Students with high mathematical ability have minor misconceptions. Subject 1, with high mathematical knowledge, experienced a misconception of calculation in question 4. This was because S1 was less thorough in making additions. This is in line with the opinion of [9], who said that the misconception of calculation is an inaccurate understanding of the concept of calculation and the use of incorrect calculation concepts, such as errors in adding up. Subject 2 with a high mathematical ability, also experienced a calculation misconception in question 4. It was seen from the wrong test results in doing the addition. Subject 3, with moderate mathematical knowledge, shared 2 on questions 2 and 4, namely, frequent and calculation misconceptions. This is because S3 is incomplete in writing down the steps for solving problems and calculating. This follows [11] opinion that students experience frequent misconceptions when they know the actions are taken in arithmetic operations but are wrong in understanding the concept. Subject 4, with mathematical ability, participates in misconceptions in 2 questions, namely questions 4 and 5. S4 has calculations and frequent misconceptions because they are wrong in determining the results and cannot write complete completion steps. Subject 5, with low mathematical ability, experienced misconceptions on questions 3, 4, and 5. S5 experienced calculation and language misconceptions because they could not understand the meaning of the story questions they were working on and could not determine the results correctly. In line with [12] that

language misconceptions can be in the form of errors in converting information into mathematical language. This also follows [11] opinion that language misconceptions occur because students cannot understand the meaning of command sentences in questions. Subject 6, with low mathematical ability, experienced misconceptions about all the questions they worked on. S6 shared frequent language and calculation misconceptions. After all, they could not write down the problem-solving procedures entirely and did not answer the questions because they could not understand the meaning of the commands in the story questions they were working on. In line with [12] that language misconceptions can be in the form of errors in converting information into mathematical language. This also follows [11] opinion that language misconceptions occur because students cannot understand the meaning of command sentences in questions. Subject 6, with low mathematical ability, experienced misconceptions about all the questions they worked on. S6 shared frequent language and calculation misconceptions. They could not write down the problem-solving procedures entirely and did not answer the questions because they could not understand the meaning of the commands in the story questions they were working on. In line with [12] that language misconceptions can be in the form of errors in converting information into mathematical language. This also follows [11] opinion that language misconceptions occur because students cannot understand the meaning of command sentences in questions. Subject 6, with low mathematical ability, experienced misconceptions about all the questions they worked on. S6 shared systematic, language, and calculation misconceptions because they could not write down the problem-solving procedures entirely and did not answer the questions because they could not understand the meaning of the commands in the story questions they were working on. 342) that the misconception of language occurs because students cannot understand the meaning of the command sentence in the problem. Subject 6, with low mathematical ability, experienced misconceptions about all the questions they worked on. S6 shared systematic, language, and calculation misconceptions because they could not write down the problem-solving procedures entirely and did not answer the questions because they could not understand the meaning of the commands in the story questions they were working on. 342) that the misconception of language occurs because students cannot understand the meaning of the command sentence in the problem. Subject 6, with low mathematical ability, experienced misconceptions about all the questions they worked on. S6 shared frequent language and calculation misconceptions. They could not write down the problem-solving procedures entirely and did not answer the questions because they could not understand the meaning of the commands in the story questions they were working on.

5 Conclusion

From the studies conducted by authors, there are misconceptions in Mathematics in grade 1 elementary schools on addition and subtraction material, namely systematic misconceptions, calculation misconceptions, and language misconceptions. This study describes some misconceptions in students with high, medium, or low mathematical abilities in addition and subtraction arithmetic operations.

This study has several limitations. Namely, authors can only examine 3 types of misconceptions that occur: frequent misconceptions, calculation misconceptions, and

language misconceptions in addition and subtraction arithmetic operations. And only able to explore a few students in one elementary school grade 1 with high, moderate, and low math abilities. Subsequent studies on misconceptions are expected to examine more misconceptions that occur with more subjects and broader material.

There are several suggestions that the author would like to convey. Teachers are expected to be more creative in developing engaging learning for students to reduce the occurrence of misconceptions and motivate students to participate enthusiastically in education. For students to study harder and not be lazy, and for parents to always pay attention and guide their children when looking at a home.

6 Authors' Contributions.

Author 1 is in charge of collecting data and drafting articles. While author 2 is in charge of reviewing articles.

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