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Analysis on Mathematics Learning Misconceptions of the Second-Grade Students of Elementary School in Addition and Subtraction Integer Topics

Markus Sujarwo[1], Sudiyanto[2] *, Sandra Bayu Kurniawan[3]

[1]Sebelas Maret University
[2,3]Sebelas Maret University

[1] sujarwofic@gmail.com , [2] * soeddie.fkipuns@gmail.com , [3]sandrabayukurniawan@gmail.com

Abstract: Mathematics concepts in primary school are basics concepts to understand mathematics concepts in the next grade. Therefore, mathematics misconceptions of primary school students should be avoided because they may affect the acquisition of the next concepts. This study was aimed to explore the types of misconceptions and to describe the causes of misconceptions experienced by the second-grade students of primary school in mathematics learning on the topic of integer counting operations. This study was qualitative descriptive research. The subject of the study was 136 second-grade students of Pangudi Luhur Primary School in Surakarta. The prime data was acquired through a conceptual understanding test in the form of essay questions as a daily assessment. The secondary data was acquired through teacher and student interviews to investigate misconceptions and causes. The results of the study: 1) mathematics misconceptions of primary school students mostly found in a two-digit double number operation with a one-time save, a two-digit reduction operation by borrowing once, the addition and subtraction operations of two double-digit integers which were presented in short-stacked forms. 2) mathematics misconceptions of primary school students mostly existed because the students did not master the concepts of number value, place value, and pre-conception reduction operations, teachers rarely used concrete objects as learning media, and teachers did not provide a sufficient correction on students' works.

Keywords: *misconception, basic mathematics learning, integer counting operations*

INTRODUCTION

Mathematics is one of the important branches of science to be learned by every student. School mathematics is a mathematics learning which is taught from elementary school to high school. Mathematics is a science that is taught gradually and uses the spiral method. The school mathematics consists of the selected parts of mathematics to develop the abilities and to create individuals, and it is guided by science and technology (Suherman, 2001). One of the purposes of mathematics learning in elementary school is to understand the mathematics concepts, to explain the relationship between concepts, and to apply the concepts or algorithms flexibly, accurately, efficiently, and precisely in problem-solving (Department of Education 2016).

School mathematics is taught from the concrete stage, semi-concrete stage, and then the abstract stage. Mathematics also has a hierarchical nature in which there is a relation between one concept with another concept. The concept is the term is used for holistic understanding which results in a generalization of an idea or some ideas (Ghulam & Khalil, 2016). As revealed by Skem (Orton, 2006) that the mathematical concepts are arranged hierarchically, one concept is the basis for other concepts. This means that in learning a new concept, the students are required to have an adequate understanding of other concepts which are prerequisites of the concept. If the students do not understand the prerequisites concepts, then the student will have trouble, unsuitability of concepts, even experience misconceptions.

Novak and Gowin (in Gül & Mustafa, 2008) explain that misconception is an interpretation of the concepts in a statement which cannot be accepted. Misconceptions can also be understood as an understanding of the concepts that are inconsistent with the scientific understanding or agreement among experts in the field (Suparno, 2013). Thomson and Logue (2006) define misconceptions as someone's mistake in understanding an idea or concept that is built based on his experience. Mathematics misconceptions may also be errors in the application of a rule or a generalization that is less precise (Dzulfikar & Ayu, 2017). Mathematical errors cannot be avoided as children develop their alternative meanings of mathematics all over the world (Mohyuddi. 2015). A misconception, on the other hand, is the result of a lack of understanding or in many cases misapplication of a „rule" or mathematical generalization (Spooner, 2002). Thus it can be synthesized that misconception is the understanding of the concept that is incompatible with the concept agreed upon by experts in the field. The misconception may be an error in the interpretation, the application of a rule or the generalization of a concept.

Misconceptions in mathematics can be a serious problem because the error of the basic concepts can lead the student in continuous errors (Andini, 2012) and will have an effect on learning outcomes for the student. Hence, misconceptions that occur need to be recognized and sought solutions. Teachers are an influential factor to find solutions for students' misconceptions. However, the teacher is also a contributing factor to the occurrence of students' misconceptions. Misconceptions and errors must not be seen as obstacles or 'dead ends', but must be regarded as an opportunity to reflect and learn. Teachers should recognize these misconceptions; prescribe appropriate instructional strategies to be more diagnostically oriented to avoid any subsequent major conceptual problems. Diagnosis should be continuous throughout instruction (Roselizawati. 2014). The inability of teachers in understanding a concept and provide a concept of learning can lead to students' misconceptions. As revealed by Amini (2005) that there is a relation between the mathematics misconceptions that occurred on students and the ones on teachers.

The addition and subtraction operation of integers is one of the mathematics substances in the second grade of elementary school. This material is part of the mathematical material held in the learning process by using an integrated thematic approach. The student is required to master the basic competencies of knowledge and skill (Department of Education, 2018). Basic competency of knowledge states that every student can explain and perform the addition and subtraction involving numbers count up to 999 in daily life and associate the addition and subtraction. Basic competency of skill describes that every student solves the addition and subtraction problem involving numbers count up to 999 in daily life and associate of addition and subtraction. Basic competency requires students to master the concepts of addition and subtraction operation of numbers with a variety of techniques, two of them are the integer addition operation with one-time save technique and the integer subtraction operation by borrowing once technique.

The second-grade students of Pangudi Luhur Elementary School which consists of four classes (group learning) learn both basic competency with a thematic approach. Based on the interviews with teachers, the teachers stated that student has difficulty in learning addition and subtraction operation of integers. Students' competency achievements for those two competencies are very low. Many students have misconceptions in solving the problem of the addition and subtraction operation of integers.

The misconceptions problem in second-grade students of primary school in mathematics learning needs to be analyzed. Therefore, the researcher set some research questions: What are the types of misconceptions experienced by the student in grade two of primary school in

mathematics learning on addition operation with one-time save technique and subtraction operation by borrowing once technique at two-digit integers? What factors that cause the second-grade student of an elementary school experiencing misconceptions in mathematic learning on addition operation with one-time save technique and subtraction operation by borrowing once technique at two-digit integers? Therefore the purposes of this study are to identify the kinds and the causal factors of misconceptions experienced by the student in grade two of primary school in mathematics learning on addition operation with one-time save technique and subtraction operation by borrowing once technique at two-digit integers.

METHOD

This research is a qualitative descriptive study to identify the kinds and the causal factors of misconceptions experienced by the second-grade students of an elementary school in mathematics learning on addition operation with one-time save technique and subtraction operation by borrowing once technique at two-digit integers. The subject of this research was the second-grade students of Pangudi Luhur Elementary School in Surakarta, Central Java. The subject of this research was 136 students which were divided into four classes.

The research data was collected through tests and interviews with students and teachers. The tests were in the form of a quiz and essay daily assessment which was held in the learning process. The interviews were conducted to deepen the cause of misconceptions reviewed both by students and teachers.

Based on preliminary data obtained, the researcher reduced the subject data into four students to deepen the types of misconceptions experienced and the causal factors. This study used a triangulate technique to check the validity of the data (Sugiyono, 2015).

RESULTS AND DISCUSSION

Student A Misconception Type

Based on the work of student A, I found a misconception about the addition operation of integers with a one-time save technique. The shape of the student A misconception is as follows.

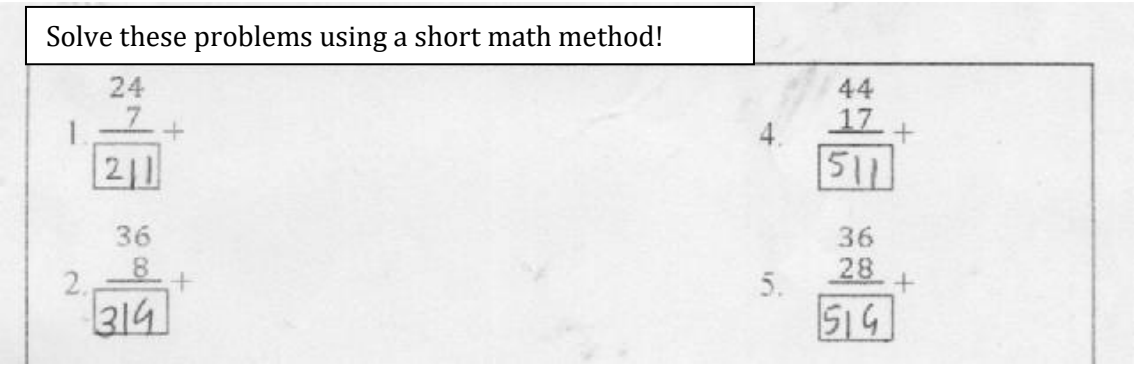

Figure 1. Student A misconception type on addition operation

Figure 1 shows an understanding of student A for the sum of two-digit with one digit numbers (question number 1 and 2) and the sum of two two-digit numbers (question number 4 and 5) by using a one-time save technique. The results of tests undertaken by student A demonstrated a concept misunderstanding in performing the addition operation of integers with

one-time save technique for the sum of two-digit with one-digit numbers and two-digit with two-digit numbers.

In the interview, student A was quite sure that the anwers were correct. Student's confidence was shown to the observer by stating that the question 1: Student A stated that 4 + 5 = 11, then immediately wrote number 11 in the result column, and then wrote down number 2 on the left side of number 11, because there were no numbers added. Hence, the result of the counting operation in problem number one was 211. Similarly to Question 2, Student A stated that 6 + 8 = 14, then directly wrote number 14 in the result column, then number 3 was written directly next to the number 14, so the result was 314.

Student A explains when asked by researchers related the answers to the numbers 4 and 5. The student explained in Question 4, that 4 + 7 = 11, then the result is written in column number 11, then 4 + 1 = 5, it is written numeral 5 also number 11 on the left column of the results, so that it becomes 511. The student explains to question 5, that the 6 + 8 = 14, then the number 14 is written in the column of results, then do a sum 3 + 2 = 5, then the 5 numbers written next to the left number 14 in the results column.

When did investigators ask why the result is a lot to Question 1 and 2? Student A states that the process steps to be one-on-one, and the result is correct. Researchers further ask students to performs a counting technique, the learner A does not want to do and believe that the result is correct. Student A stated that his mother taught him to add like this way.

Student A also experienced a similar misconception, although different forms of matter. Misconceptions also occur when students A working model of matter as follows.

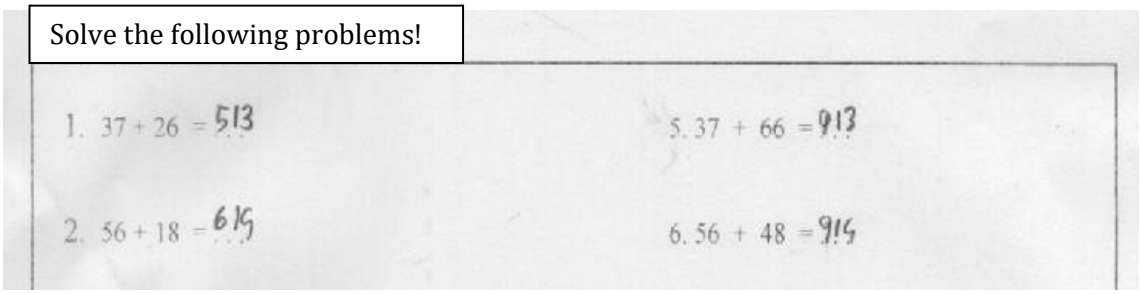

Figure 2. Student A misconception type on addition operation

Figure 2 is a learner A work that shows that student A encounter misconceptions about the shape as in Figure 1 and described in the description.

Based on the above, student A encounters misconceptions about the procedure of writing the sum of short tiered. Student A has been able to do a sum basis. Results of the sum are correct but do the next step, student A is not doing right. Student A does not undertake steps to save tens numbers as part of a technique to save, but immediately write it down. A step that causes the sum to be wrong. Thus, misconceptions student A is a kind of misconception summation procedure with techniques to save one. This procedure misconceptions mention for misinterpretation that the place does not affect the value of a number (Burn, 2007),

Researchers in conducting classroom observations during student A teacher does not accurately perform summation example. Teachers simply state that when summing units and units and generate the number of tens, then the number of tens is stored in the head first and then add tens. This makes the teacher step student A confused in working on it.

When did researchers ask the teachers why teachers are not guided step by step process of learning and using instructional media? The teacher answers that most students have understood the way used by teachers. Researchers concluded that the way teachers teach and student media

lack a major cause misconceptions student A procedural experience. Student A does not get enough information, such as procedures related to a concept, so the concept of the building is mistakes interpretation or application of a rule (Dzulfikar & Ayu, 2017). Teachers also do not make corrections and remedial towards student A. This will lead student A misconception continue in different forms craftsmanship as evidenced in a matter like a Figure 2.

Misconception type Student B

Based on the work of the students B, also found misconceptions about reduction surgery integers with techniques borrowed one. The shape of misconceptions student B is as follows.

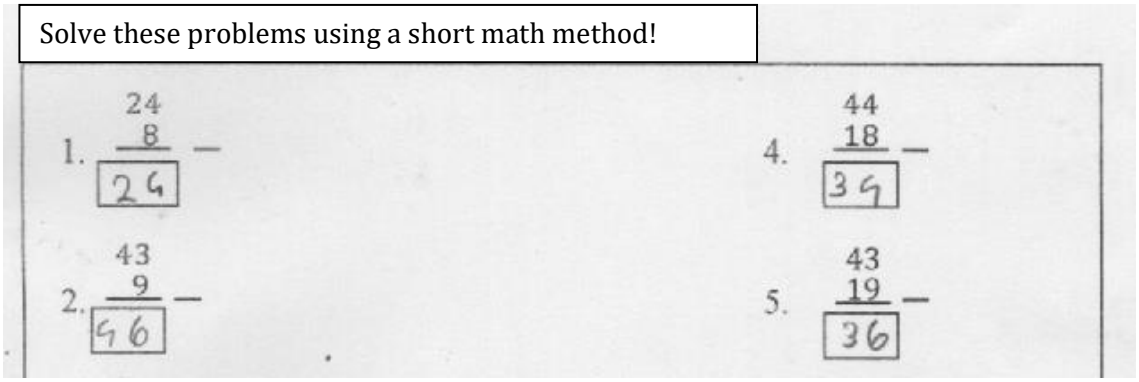

Figure 3. Type misconceptions reduction surgery student B

Figure 3 states the understanding of student B in solving arithmetic operation subtraction short tiered double-digit numbers by one-digit and two-digit numbers by two-digit numbers. The results of tests undertaken by student B showed an erroneous understanding of the concept in the operation subtraction of integers.

At the time of the interview, student B stated that he was convinced that the answer is correct. When asked to explain workmanship Question 1, student B explains that 4-8 is not, then it does is 8-4 and the result is 4. Then for 2 nothing reduces the fixed, so that it becomes 24. Similarly, question 2, student B explains that 3-9 can not, then it can be is 9-3, then the result is 6, then as 4 can not be reduced, the result is 46. When investigators asked for explanations about the craftsmanship associated with the number 4 and 5, student B explained that a large number of small numbers is reduced, then the results are respectively 34 and 35.

Based on the results of students understanding B as contained in figure 3, student B encounter misconceptions associated with a reduction in integer operations. Student B filed false reasoning. This is in line with the statement Suparno (2005) that reasoning is wrong can lead to misconceptions students. Thus, misconceptions student B is a misconception caused by faulty reasoning in the reduction operation. Error student B is stated that the numbers can be reduced to be a lot more numbers, so there is no process to "borrow".

Researchers observed during the learning process of students in the class. In the learning process, the researchers found that teachers did not focus to give careful steps in learning. The teacher gives an example quickly and then give matter to all student. Student B does not understand how the concept of subtraction of integers appropriately. The researcher argues that teachers play a role in students' misconceptions B.

Misconception type Student C

Based on the work of student C is found operating misconception integer arithmetic sum of the two digits

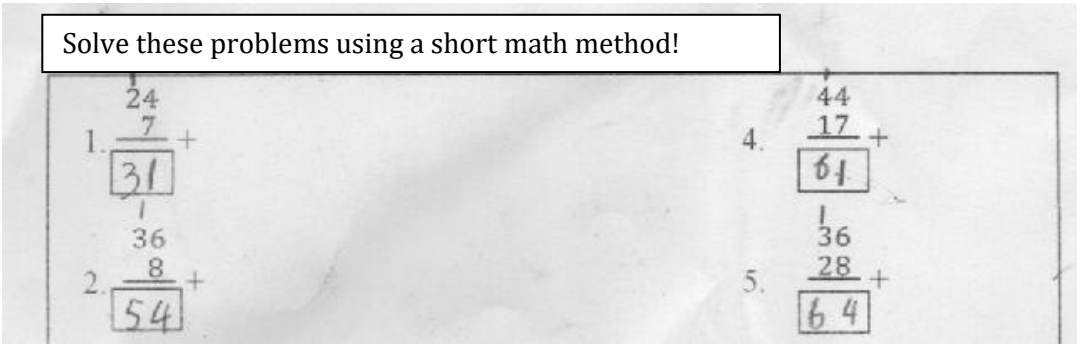

Figure 4. The workmanship of student C

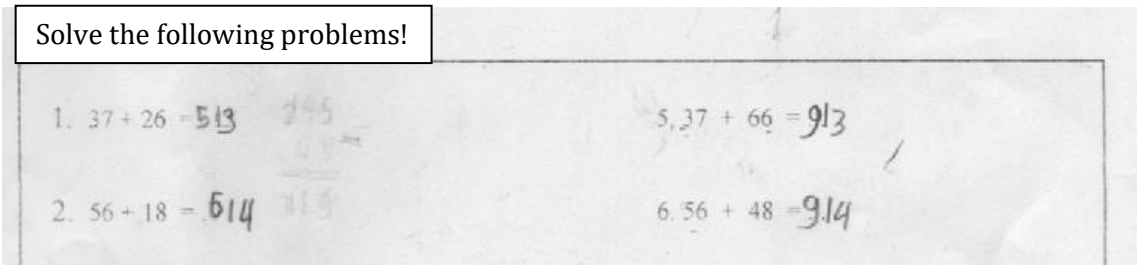

Figure 5. The workmanship of student C

Figures 4 and 5 express the understanding of student C in solving the sum of different forms. Student C can use the measures summation with a short tiered manner, even if Question 2 is incorrect. When student C is given on the operation of two-digit integer addition with horizontal form, student C encounter misconceptions.

Student C stated that the difficulty in answering the questions as in picture 5. Student C can explain that the first step is to add 37 + 26 is a summing unit which is 7 + 6 = 13, but student C directly write it 13, then, when adding 3 + 2, student write the results (5) next to the left number 13, so that it becomes 513. Answer students this is the wrong answer. A student experiencing misconceptions such as errors in the summation procedure. Student C it shall save tens (number 1, at 13) then add up to a sum of tens so that it becomes 63.

Misconceptions experienced by student C continues to occur. This is evidenced by the same processing steps to answer questions number 2, 5 and 6 as in Figure 5. Student C encounter misconceptions and continuously perform processing misconceptions about the number.

The teacher who teaches student C has been doing individual guidance to student C. However, teachers are not using instructional media and make corrections appropriately. The absence of instructional media causes trouble students to understand a concept, especially students who are still in the development stage of preconceptions. The absence of remedial programs also covers the opportunities for student C to reduce misconceptions that happened.

Misconception type Student D

Based on the work of student D is found operating misconception integer arithmetic sum of the two digits

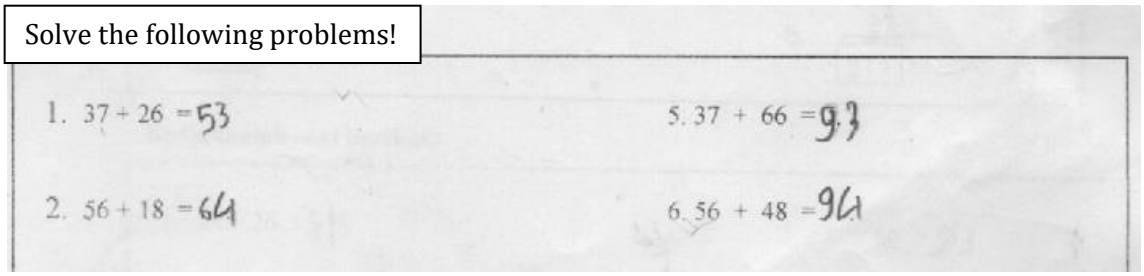

Figure 6. Type misconceptions student reduction operation D

Figure 6 expressed an understanding of student D in solving arithmetic summation operation is horizontal. Student D summation of the numbers that occupy the unit area value in the two-digit numbers as a first step. Student D then write the results only on the unit, for example, student are writing numbers 3, the sum of 7 + 6, on Question 1. Student D did write the first step as the dozens of "saved" so that when summing 3 + 2, the student still write 5 as the result, but the result should be plus 1, as a result of which "saved". The student continues to perform the same steps to do problem number 2, 5, and 6.

Student D experienced continuous misconceptions. Misconceptions student D can be caused due to an error in generalizing a concept. The concept is not fully understood by student D D lead student do misconception in the next step

CONCLUSIONS

Mathematics misconceptions on addition operation of integers with a one-time save technique in the second-grade student can be procedural and interpretation misconceptions of a basic concept and generalization. Student's misconceptions may occur in mathematics short method addition and horizontal addition problems. This misconception is due to the student's inadequate concept about the place value of numbers. The inadequate prerequisite concept leads the student to have misconceptions in the next concept.

Mathematics misconceptions on subtraction operation of integers with borrowing once technique are due to student's insufficient preconceptions. An improper preconception of a subtraction operation is due to student's contextual experience in performing the subtraction operation. Student perceives that the numbers to be reducted should be greater than the deductions.

The causal factors of student's misconceptions may be the student's inadequate ability to master the prerequisite concept, inadequate reasoning ability, and wrong basic concept. The supporting factor which drives the misconception is teachers who did not use learning media, did not conduct adequate remedyes and did not provide adequate corrections for student's work.

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