Types Of Elementary Student Representations In Solving Problems Of Reducing Round Numbers

Lidwina Cornelia Maniboey, Cholis Sa'dijah, Hery Susanto, Subanji

Abstract: This study aims to describe the types of representation of integer reduction in elementary school students. The subjects of this study were 22 students of grade IV SDK Sang Timur Malang and 23 students of class V of SD YPPK St. Petrus Jayapura. Data collection was carried out in two stages using assistive instruments, namely the LTS question sheet consisting of 3 item items, and task-based interviews. In the first stage, students' complete questions consisting of 3 items, while researchers observe student learning activities while writing important notes to be confirmed at the interview. In the second stage, task-based interviews to explore and clarify the types of representations made by students and capture data that has not been obtained through test results. The data that has been obtained are analyzed by the stages of transcribing data, reducing data, categorizing data, drawing thinking structures, and making conclusions. The results of the study on the type of representation of deduction of integers in elementary school students, consisted of 4 types, namely the type of number line representation, the type of image representation of numbers, the type of representation of number models, and the type of image representation and number lines.

Index Terms: Elementary Student, Representation, Round Numbers.

1 INTRODUCTION

Learning mathematics in elementary schools, is not just giving information to students and is taken for granted as memorization, but rather how to make students learn and have an understanding of a mathematical concept. One of them is in learning about numbers and subtraction operations.The NCTM standard for numbers and operations identifies three general objectives for students in kindergarten through grade 5 elementary school (NCTM, 2000) namely 1) To understand numbers, how to represent numbers, relations between numbers, and number systems; 2) To understand the meaning of operations and how the relationships between them; and 3) To calculate smoothly and make estimates (estimates) based on logic (NCTM, 2000). Thus, one of the learning objectives for 5th grade elementary school students is to be able to understand the meaning of integer reduction operations with the prerequisites of students understanding integers, how to represent integers and the relationships between integers themselves. On subtracting positive integers with subtractions smaller than those subtracted, students can immediately subtract them, for example at 5-3 = ..., but what about subtracting positive integers with subtraction greater than subtracted numbers, for example 3-5 - .... Likewise with subtraction with negative numbers, for example 5- (-3) = ... In forms of subtraction problems like this, students need representation, because students are still at a concrete stage.Bishop, 2014, researched effective ways of reasoning to reduce negative numbers, using numerical line representations and verbal representations that count down.

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Bofferding, 2015, examined the mental models and difficulties of students understanding the concept of negative integers, making mistakes by solving problems 3 - 5 equal to 5 - 3, and how younger students understood negative numbers, using verbal representations to count forward and backward.In elementary school the teacher can introduce the idea of the situation of negative numbers with money, balls, temperature, and the number line. Activities provide a background for understanding positive and negative integers with symbols, such as +4 and -4. The use of these signs can cause confusion with signs of addition and subtraction. For these and other reasons, formal work with integers is now recommended for secondary schools rather than elementary school students. A few simple activities based on positive and negative number pairs introduce operations. Red chips are positive numbers and blue chips are negative integers. The writing format for positive and negative numbers must be indicated by writing different plus and minus signs to distinguish them from the plus and minus signs which are commonly used for addition and subtraction (see figure 1). Adding three red chips and three blue chips creates a zero because each pair of positive and negative chips has zero. Students can refer to chips and opponents as much to show that they cancel each other out (Kennedy, 1997; 1990).

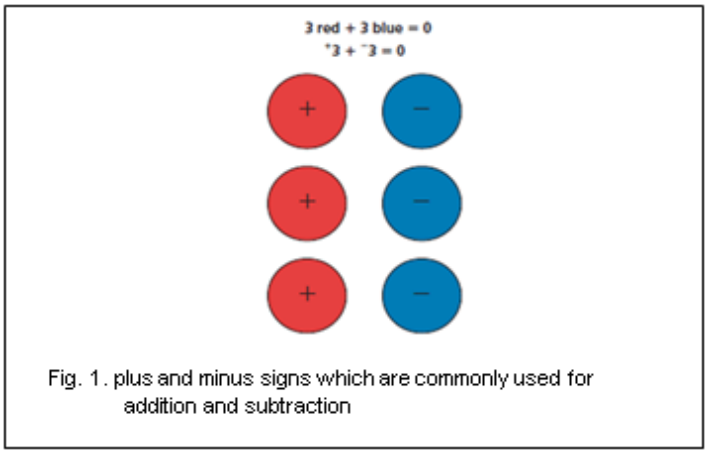

Fig. 1. plus and minus signs which are commonly used for addition and subtraction

Students in solving the problem of reducing integer namely 5 - (-3) = 5 + 3 = 8. So that the question arises, what representation does the student actually have, so that he

answers correctly by changing the subtraction problem into a matter of adding 5 + 3 = 8. Representation is a model or substitute form of a problem situation that is used to find a solution. For example, a problem can be represented by objects, images, words, or mathematical symbols (Jones & Knuth, 1991). Representation is a method used by someone to communicate the answer or mathematical ideas in question. Representations raised by students are expressions of mathematical ideas or ideas that are displayed by students in their efforts to find a solution to the problem being faced (NCTM, 2000: 67). According to Pape & Tchoshanov (in Luitel, 2001) there are four ideas used in understanding the concept of representation, namely: (1) representation can be seen as an internal abstraction of mathematical ideas or cognitive schemata built by students through experience; (2) as a mental reproduction of a previous mental state; (3) as a structural presentation through images, symbols or symbols; (4) as knowledge about something that represents something else. Representation is a process of mental development that a person already has, which is revealed and visualized in various mathematical models, namely: verbal, pictures, concrete objects, tables, manipulative models or a combination of all (Steffe, Weigel, Schultz, Waters, Joijner, & Reijs in Hudoyo, 2002: 47). Cai, Lane, and Jacabcsin (1996: 243) state that a variety of representations that are often used in communicating mathematics include: tables, pictures, graphs, mathematical statements, written texts, or a combination of them all. Hiebert and Carpenter (in Hudoyo, 2002) suggest that basically representations can be distinguished in two forms, namely internal representations and external representations. Thinking about mathematical ideas which are then communicated requires external representations whose form includes: verbal, pictures and concrete objects. Thinking about mathematical ideas that allow one's mind to work on the basis of these ideas is an internal representation. From the description above it can be concluded that representation is a form of interpretation of students' thinking of a problem, which is used as a tool to find solutions to those problems. Forms of student interpretation can be in the form of words or verbal, written, drawing, tables, graphs, concrete objects, mathematical symbols and others.

Lesh, Post and Behr (in Hwang, Chen, Dung, & Yang, 2007) divide representations used in mathematics education in five types, including real world object representations, concrete representations, arithmetic symbol representations, verbal or verbal language representations and image representations or graph. Representation in learning mathematics, is not only presented in one way of representation, but can also be a combination of one or more representations (Kartini, 2009). Each student has a different way to construct their knowledge. In this case, it is very possible for students to try various kinds of representations in understanding a concept. Besides representation also plays a role in the process of solving mathematical problems. As Brenner states that the successful problem-solving process depends on the skill of representing problems such as constructing and using mathematical representations in words, graphs, tables, and equations, symbol resolution and manipulation (Neria & Amit, 2004: 409).

However, in learning mathematics so far students have never or rarely been given the opportunity to present their own representations. Students tend to imitate the steps of the teacher in solving problems. As a result, students' mathematical representation ability does not develop. Though mathematical representation is very necessary in learning mathematics, both for students and for teachers. Perhaps this is due to the teacher's limited knowledge of mathematical representation and its role in mathematics learning. This research will examine theoretically about the forms of representation what students do in solving the problem of reducing integers with negative deductions, as in questions 3 - 5 and 5 - (-3). The actions taken in this study, use more than one form of representation.

2 METHOD

This type of research is a qualitative research with a descriptive exploratory approach. Subject selection is done by 1) giving test questions, 2) selecting prospective subjects into group representations, 3) selecting prospective subjects based on communication skills. There are 3 items of test questions to solve subtraction problems according to the selected representation. The instruments used in this study consisted of two types, namely the main instrument and the assistive instrument. The main instrument in this study is the researcher himself. Assistive instruments consist of task-based interview guidelines and integer visual aids.

3 RESULTS AND DISCUSSION

Based on the analysis of the results of the tests and interview results, obtained 4 types of student representation in reducing integers.

3.1 Type of Line Representation

Students with the number line representation type, only use the number line representation to solve the integer reduction problem as shown at Figure 2.

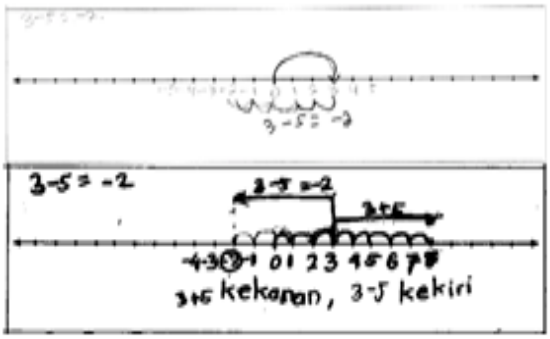

Fig. 2. Type of Line Representation

3.2 Types of Image Number Representations

Students with the image representation type numbers, only use the image representation of numbers to solve integer reduction problems as shown at Figure 3

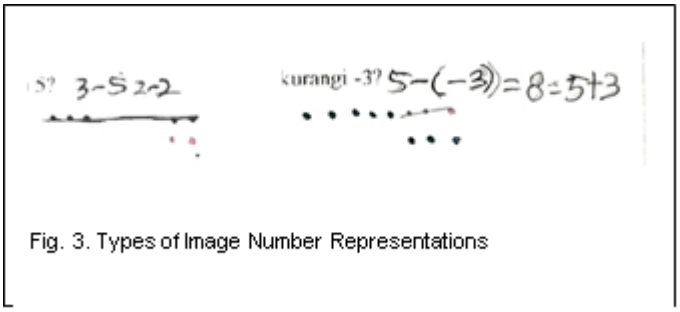

Fig. 3. Types of Image Number Representations

3.3 Types of Representation of Number Models

Students with the type representation of the number model, use the number model to solve integer subtraction problems as shown Figure 4.

Fig. 4. Types of Representation of Number Models

3.4 Types of Representation of Number Lines and Figure Numbers

Students with the type representation of the number model and figure numbers to solve integer subtraction problems as shown at Figure 5.

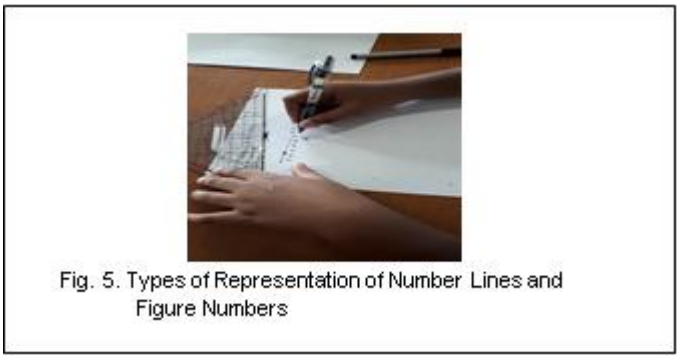

Fig. 5. Types of Representation of Number Lines and Figure Numbers

4 CONCLUSIONS

From the description above it can be concluded that representation is very instrumental in helping to understand mathematical concepts. Each student has a different way and requires concrete representation to construct their knowledge in the form of the concept of symbolic integer reduction, which is not only presented in one way of representation, but can also be a combination of one or more

5 REFERENCES

[1] Bishop, et.al., 2014. Obstacles and Affordances for Integer Reasoning: An Analysis of Children's Thinking and the History of Mathematics. Journal for Research in Mathematics Education, Vol.45. No.1, 19-61.

[2] Bofferding, 2014. Negative Integer Understanding: Characterizing First Graders' Mental Models. Journal for Research in Mathematics Education, Vol. 45, No. 2 (March 2014), pp. 194-245.

[3] Cai, Lane, Jacabcsin (1996). "Assesing Students' mathematical communication". Official Journal of Science and Mathematics. 96(5).

[4] Hwang, W.-Y., Chen, N.-S., Dung, J.-J., & Yang, Y.-L. (2007). Multiple Representation Skills and Creativity Effects on Mathematical Problem Solving using a Multimedia Whiteboard System. Educational Technology & Society, Vol 10 No 2, pp. 191-212.

[5] Hudoyo, H (2002). Representasi Belajar Berbasis Masalah. Jurnal Matematika dan Pembelajarannya. ISSN: 085-7792. Volume viii, edisi khusus

[6] Jones, B.F dan Knuth, R.A. (1991). What does Research Say about Mathematics?. [Online]. Tersedia:http://www.ncrl.org/sdrs/stwesys/2math.html. [20 November 2013]

[7] Kennedy, Leonard. M., 2008. Guilding Children's Learning of Mathematics. Thomson Higher Education. Thomson Wadsworth, a part of The Thomson Corporation. Thomson, the Star logo, and Wadsworth are trademarks used herein under license.

[8] Luitel, B.C. (2001). Multiple Representations of Mathematical Learning. [online]. Available: http://www.matedu.cinvestav.mx/adalira.pdf