STUDENTS' REPRESENTATION IN SOLVING WORD PROBLEM

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Abstract

The purpose of this research is to describe the representation of sixth grade students in solving mathematics word problems. The focus of the representation of this research is an external representation which is viewed from students with high mathematical abilities. The method used in this research is task-based interview, by giving a problem test of word problems. Students who have a high level of abilities, he makes pictures of all problems and successfully solve the problems. Students whose level of abilities is lacking, he only makes incomplete symbol / verbal representations, he has wrong when solving the problems. Various kinds of representations and increasing abilities in many problems such as multiplying exercises and solve the word pronlem. Applying various representations to students are very important to be improved by students in order to succeed in solving various mathematical word problems.

Keywords: Representation, Solving Problem, Word Problem.

Abstrak

Tujuan dari penelitian ini adalah mendeskripsikan reprsentasi siswa kelas VI dalam menyelesaikan masalah cerita matematika. Fokus representasi penelitian ini adalah representasi eksternal yang ditinjau dari siswa berkemampuan matematika yang tinggi. Metode yang dilakukan dalam penelitian ini wawancara berbasis tugas, dengan memberikan tes masalah soal cerita matematika. Siswa yang memiliki tingkat pemahaman yang tinggi membuat gambar dari semua masalah dan berhasil menyelesaikan masalah. Siswa yang tingkat pemahamannya kurang, dia hanya membuat representasi symbol/verbal tidak lengkap, dia tidak tepat dalam menyelesaikan masalah. Berbagai macam representasi dan meningkatkan pemahaman dari berbagai masalah yang ada seperti memperbanyak latihan soal dan menerapkan berbagai representasi kepada siswa memang sangat penting untuk ditingkatkan oleh siswa supaya berhasil dalam menyelesaikan berbagai masalah cerita matematika.

Kata Kunci: Representasi, Menyelesaikan Masalah, Masalah Cerita.

INTRODUCTION

Representation is very important in learning mathematics, it is stated in NCTM (2000) which states that representation is the core of mathematics study. Students can develop and deepen their understanding of concepts and mathematical relationships as they create, compare, and use multiple representations. Representations such as physical objects, images, and symbols can help students communicate their thoughts. Representations can represent the students' minds of representations captured by the brain, and are reproduced back into another form (Markmann, 1999). Salkind (2017) reveals that representations are useful, in mathematical learning. Objectives for student learning include the development of internal representation systems, understanding traditional external representation systems, creating and using representations as a tool for communication and problem solving. One emerging theme is that student learning involves establishing relationships between different types of representation: pictorial and symbolic; verbal and visual; internal and external. External representation systems are usually symbolic. The system of internal representation is made in one's mind and is used to define mathematical meanings. Numbering systems, mathematical equations, algebraic expressions, graphs, geometric figures, and numerical lines are examples of external representations (Goldin & Shteingold, 2001). External representation has been developed and widely used in various learning. External representation is a written and spoken language.

Resolving a problem is an attempt to find a way out of a difficulty, reaching a goal that can not be achieved immediately (Polya, 1981). Stages in settling by Polya are understanding the problem, planning the settlement, executing the settlement plan and re-examining the result of the settlement. Resolving word problems is one of the important components of mathematical problem solving that combines problems and everyday life, but many studies reveal that students express great difficulty in dealing with word or matter of story (Ahmad, Tarmizi, & Nawawi, 2010; Boonen et al., 2014; Van der Schoot et al., 2009). The term word problem is used to refer to mathematical exercises where significant background information on the problem is presented as text rather than in mathematical notation, since word problems often involve such narratives, they are sometimes also referred to as word problems (Boonen et al., 2013). As Gagne (Ahmad et al., 2010) suggests, in the process of solving the problem of mathematical stories, students must be able to translate concretely into abstract or abstract to concrete. Hence the problem solving of the story is more unique and a challenging task than the usual mathematical task.

Students usually find difficulty in solving the initial word problem from translating word representation into mathematical representations. Particularly in science, visual images are preferred to display many relationships and processes that are difficult to describe. Research studies show that this type of visual representation can determine how strongly illustrations will be a learning aid and facilitate in solving a problem. In psychology, mathematical representation means the description of the relationship between the object and the symbol. There are two tipes of representation in this research, namely external representation (real world) and internal representation (in mind). Lesh, Post & Behr (1987) shows the five external representations used in mathematics education including real-world representation of objects, concrete representations, arithmetic symbol representations, oral language representations, and visual images or representations. The representation of arithmetic symbols, oral representations of language, and images or visual representations, is a more abstract representation and a higher level of representation for mathematical problem solving (Hwang et al., 2007). The ability to represent the spoken symbols is the ability to translate the properties examined and their relation to mathematical problems into verbal representations.

The ability to represent written symbols is the ability to translate mathematical problems into the representation of mathematical models. The ability to represent images is the ability to translate math problems into images, diagrams, or graphs. Abstract mathematical ideas or concepts can be concrete and more easily understood if planned or deliberately planned by the teacher in multi-representation, so that the learning can run smoothly, and the goal is optimal (Hwang et al., 2007).

METHOD

The type of research used in this study is descriptive qualitative research with the purpose of this study describes the representation of elementary students in solving word problem. The problem is given as follows:

1. Dalam perlombaan atletik, Jim berada empat meter di depan Tom dan Peter berjarak 3 m di belakang Jim. Seberapa jauh Peter di depan Tom?
2. Nindi berjalan kearah utara dari rumahnya menuju kekota A dengan jarak 66 Km, lalu dia pergi kekota B dengan jarak 13 Km kearah timur. Beberapa saat kemudian dia disuruh ibunya pergi kekota C sejauh 66 Km kearah selatan. Oleh ibunya dia disuruh untuk segera pulang kerumah , berapa jarak rumah si Nindi dari kota C?

The focus of representation used in this research is external representation. The method used in this research is task-based interview, by giving math word problems. The subjects of this study were the sixth grade elementary school students in Blitar East Java with the subject of 1 male student and 1 female student with the category of high math ability based on the results of the average of the previous test scores.

The researcher acts as the main instrument that is assisted by supporting instruments for giving tests and confirmed by interviews. Early stdp conducted in making instrument summary and designing research instrument. All of instrument was validated by validator. The test is given at the time of the lesson outside, with 10 minutes working on the problem. After completing each question, a short interview was conducted to find out what representation the students used to solve the word problem. Data in this research is qualitative data. Qualitative data gained from validation result of expert to research instrumen, observation result in student activities, interview result of student. When students create visual representations, three categories are distinguished: accurate visual-schematic representation, inaccurate visual schematic representation, or pictorial representation (Boonen et al., 2014).

RESULTS AND DISCUSSION

Results

The following research results obtained from 2 subjects named (pseudonyms) Ihsan and Excelina are described as follows:

Subject of Ihsan

At the time of understanding the problem, Ihsan read over and over to understand the problem, Ihsan understood the problem (No. 2) that Nindy walked from her house and strolled through to the end of town C. Nindi walked in different directions until Nindy ended in a city C. Ihsan answered the question degan looking for problems that exist on the matter, which is calculate the distance between the city of C and Nindy's house or the starting place Nindy

started walking. Ihsan did the same in the No. problem. 1 but only briefly explained, because in the interview mentioned that those who ran a distance of only 1 meter only. Ihsan only imagined in his mind and managed to find the answer.

Ihsan drew up a settlement plan (Problem No. 2) by drawing the Nindy walking from his house to A town, then walking back east toward kora B, then heading south toward town C and ending in town C anyway. In implementing the Ihsan settlement plan begin drawing and writing out the results of the answers. Ihsan draws the boxes which he thinks is a city that the Nindy will pass. In doing this internal representation the subject of Ihsan does a visual representation of the problem internally in his mind (Hwang et al., 2007; Boonen et al., 2014), then he wrote externally in the form of drawings representing everything Ihsan know of about story (Boonen et al., 2014). In re-examining the answer, the subject of Ihsan only glance at it without counting or re-checking carefully, because the subject assumes the question of this story makes him confused and thinks he can not solve it. The same is done for problem no. 1 where Ihsan drew the shape of the person as a description of Jim, Peter, and Tom contained in the question, but only two people were drawn, when asked why only 2 people, Ihsan replied that the other one was fronted. internal representations of Ihsan are seen when interviewed based on the answers he expressed.
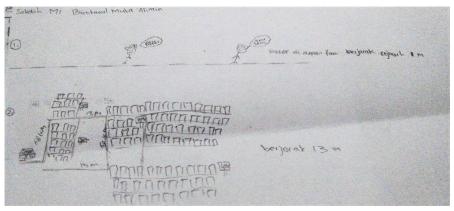

Figure 1. Ihsan Work Results

At the time of solving the problem, the subject of Ihsan performs abstraction in the form of pictorial and symbolic representation of the word problem containing any information contained in the matter of the story (Internal representation), such as drawing his city, the roads through which Nindy is in question number 2 (external representation). The internal representation of Ihsan appeared at the interview, he mentioned that 3 people were in the matter, but only 2 were drawn by Ihsan. Ihsan think of the three people in the same way but with different distances. In terms of understanding the problem, Ihsan subjects do a repetition in reading. When planning and executing a plan of completion, the subject of inspiration makes an accurate representation of the schema that describes the situation in the matter or represents again in the form of an image, any variables derived from matter into image form (Boonen et al., 2014). At the time of completing the question, Ihsan connect the knowledge of the sum of numbers and recall the form of the wake up in solving problem number 2.

Excel Subject

Excel understands the problem given by reading it for a long time and mumbling. Excel says that solving the problem of number 1 only adds it will find the answer, because it is a matter of addition and subtraction. Excel understands that question number 2 is to calculate the

distance between Nindi's house and city C which previously runs into town A, then town B, and ends in town C, which is asked is the distance from Nindy's house to town C. In executing the settlement, the excel subject adds all the distance between Nindy's house and every town that is till ends in town C as shown below
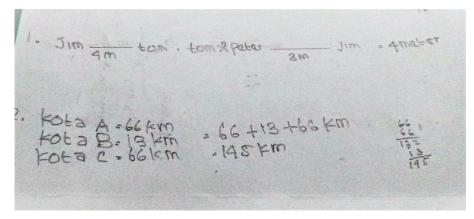

Figure 2. Excel Work Results

Excel subjects understand the problem of this story by starting and reading for a long time. In planning and executing the plan, the excel subject does not represent visually as the previous subject (Ihsan) it represents into the algebraic symbol, but is still wrong. It represents the city of A = 66 km, whereas 66 km is the distance between Nindy's house and city A. Whereas in solving this word problem it will be easier to visualize all the variables in question number 2 (Boonen, 2014). Excel solves this problem by adding all the distance that is in the matter, because the understanding of excel in question is the distance of the house and the last city distance passed by Nindy. In re-examining the results of his work, the subject of this excel is less visible, because the subject of excel only see it without counted back or read carefully the answer. In question number 1, excel responded by drawing a line on the answer. Excel in his interview replied that the problem is a trick problem, because according to excel the answer on the matter is 4 meters the same as in the matter. Without thinking long, excel justify for the result of answer about the number 1 is true without checking again.

Discussion

This research examines the importance of students' visual representation by using test items for word poblem and interview questions to explore the representations made by students in external or internal representation (Salkind, 2017). From the written test results strengthen the evidence that in solving word problems, students who draw, the answer to the problem is correct. Conversely, students who do not draw or just write, the answer to the problem is wrong. Furthermore, to see more about the representation being built, an interview was conducted. Based on the results of the interview, it strengthens the evidence that the (external) representation of writing or images written by students influences students' understanding of word problems. It was proven that after interviewing on subject 2, the level of understanding of the problem was low, using the schema representation was not accurate, the answer was wrong. Conversely on subject 1, when the interview is done based on the results of the test or the writing looks high level of understanding, using an accurate pictorial scheme representation, the correct answer.

Of the 2 research subjects, it can be seen that students who solve the problem of word problems by using better pictures and answers to solutions are more appropriate than students

who solve the problem only by making a symbolic or variable representation such as the 2nd subject (Ahmad et al., 2010; Boonen et al., 2013; Boonen et al., 2014). In solving a problem, each student does it in different ways but the stages are sequentially understanding the problem, planning a solution, completing the process and seeing the work again (Polya, 1981)

CONCLUSION

Judging from the truth of subject 1 and subject 2, it can be seen that the students who represent the solution of the story with the shape of the picture (accurate schema representation), make it easier for students to finish it and the result of the completion is also appropriate (Ahmad et al., 2010; Boonen et al., 2014; Hwang et al., 2007). Unlike the subject 2, that only represent the symbol and verbal (inaccurate schema representation) that resulted from the completion of students is less precise. In terms of understanding the problem, subject 2 looks very less. Subject 2 only describes the straight line when solving the problem, whereas much of the information contained in the subject is less noticeable by subject 2. It is seen to be able to represent students of various kinds either verbally or visually representation (Lesh, Post & Behr, 1987).

In this research, like subject two which changes (translates) city A with 66 Km, while 66 Km is the distance between Nindy's house and City A. It can be seen that students' understanding is still weak, for that the teacher needs to provide experience to improve understanding and word problem solving to student. As well as providing more knowledge to represent mathematical problems, because representation is an important part of solving mathematical problems (Salkind, 2017). In this study, students who represent the word problem by drawing what is understood in the problem (accurate schema representation) can solve the problem correctly. Students who represent with symbols or writing are not appropriate for solving problems (inaccurate schema representations).

Internal representation in this research is still a bit unearthed, because this research focuses only on students' external representation. The potential internal representation that can be explored more deeply is what students say during the interview, but in describing it in different writing forms and the students respond to it to be difficult to express in written form and in their minds. In other words is to discuss the written or written completion of the students either in the form of writing, symbols, pictures, graphics and other of the given problem. For further to further research discuss the imagination or what the student thinks about first (internal representation) in understanding the given problem as well as the process that the student does to shape, use, read, change the representation to solve the problem as well as further developed about the visual representation against the subject of teachers or other students who will later students will easily solve math problems and mewujutkan what is in the imagination of students in the form of images and symbols so easy for students to solve problems.

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