The Elementary School Students’ Mathematical Problem Solving Based on Reading Abilities

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Abstract. The aim of this research is to describe the third grade of elementary school students’ mathematical problem in solving skills based on their reading abilities. This research is a descriptive research with qualitative approach. This research was conducted at elementary school Kebran II Surabaya in second semester of 2016-2017 academic years. The participants of this research consist of third grade students with different reading abilities that are independent level, instructional level and frustration level. The participants of this research were selected with purposive sampling technique. The data of this study were collected using reading the narration texts, the Ekwall and Shanker Informal Reading Inventory, problem solving task and interview guidelines. The collected data were evaluated using a descriptive analysis method. Once the study had been completed, it was concluded that problem solving skills varied according to reading abilities, student with independent level and instructional level can solve the problem and students with frustration level can’t solve the problem because they can’t interpret the problem well.

1. Introduction

Students need Language skills to understand mathematical symbols. Language is the key of cognitive development because language is a communication tools among people. Problems solving means engaging task in which the solution method is not known in advance. Mathematics as a language which uses symbols is used to facilitate a person in doing the analysis so that it can solve the problems of life associated with the use of mathematics. A person will be able to solve math problems if supported by a language understanding with known situations and using previously familiar symbols. In order to find the solution, student must illustrate on their knowledge and through the process to solve the problem; they will often develop new mathematical understandings. Solving problem is not only a goal of learning mathematics but also a major means of doing it. Students should have frequent opportunities to formulate, grapple with, and solve complex problem that require a significant amount of effort and should then be encourage reflecting on their thinking [8]. Model of the problem solving process identifies four sequential phases: problem translation (i.e., utilizing linguistic skill to comprehend what the problem is saying), problem integration (i.e., mathematics interpretation relationships among the problem parts to form a structural representation), solution planning (i.e., determining which operations to use and the order in which to use them), and the solution execution (i.e., carrying out the planned computations to solve the problem) [5].
To elementary students, the majority mistakes in math tests are in working on a story problem that requires problem solving. Students’ wrong answers are generally caused by the reading ability, understanding, transformation, or carelessness. Students often perform one or more of the four counting operations (±, −, ×, ÷) that needed to answer the question, but they do not know which counting operations are used to solve the problem [1]. Students have difficulties in understanding the keywords appearing in problems, moreover, they cannot interpret them into mathematical sentence, students are also unable to figure out what to assume and what information from the problem is necessary to be solved. Whenever students do not understand the problem, they tend to guess the answer without any thinking process, students are impatient and do not like to read mathematical problems, students do not like to read very long problems and students have difficulties in reading and comprehension, unable to understand what important information is in a problem and organize it. In addition students cannot invert the text into mathematical symbols [10].

Language knowledge is essential for mathematical knowledge. As outlined at the beginning, students need a repertoire of literacy skill to cope with school task. Language knowledge supports students in decoding mathematical terms. They need literacy skills to understand words and the structure of sentences used in terms, e.g. operators, which play an important part in action knowledge for the solution of items or relations between words, important for conceptual knowledge [12]. Learning mathematics is particularly intertwined with good technical reading skills, even in adolescence [6]. When solving problems that include a story, students are required to understand the language of the problem and the concrete information presented in the problem, to properly conceptualize the problem in his/her mind based on the information given within the problem, to design and follow a plan and to make the calculations required by the solution process of the problem[11].

Problem solving requires reading, reading comprehension and the use of mathematics, as well as the use of mathematical operations. Students who have trouble reading the problem can’t provide the correct answer [4]. Problems solving means engaging in task in which the solution method is not known in advance. In order to find the solution, student must draw on their knowledge and through this process; they will often develop new mathematical understandings. Solving problem is not only a goal of learning mathematics but also a major means of doing it. Students should have frequent opportunities to formulate, grapple with, and solve complex problem that require a significant amount of effort and should then be encourage reflecting on their thinking [8].

To read mathematics textbooks, answer questions on mathematics assessments, and understand educator and student communication, students must develop an understanding of the academic language of mathematics [9]. Students who experienced difficulties in reading a problem were unable to provide correct answers. In addition, correct vocalization of the problem may not be enough for finding the correct solution to a problem, because the mathematical language involved in the problem must also be understood. There is also a need for students to develop strategies besides understanding the language of the problem and the mathematical language involved in the problem. In addition to the development strategies, how to administer these strategies to new situations then must be mastered. Strengthening teacher-student and student-student relationships is great importance for the understanding of problems [7].

2. Method
This research is a descriptive research with qualitative approach. This research was conducted at elementary school Kebraon II Surabaya in second semester of 2016-2017 academic years. The subject of this research consists of third grade students with different reading abilities that are independent level, instructional level and frustration level. The subjects of this research were selected with purposive sampling technique. To determine the subject of research, the researcher chooses the subject by knowing their reading abilities. In this case students of grade III-B are given a reading text, and then students are asked to read the test aloud. After that, researcher recorded students’ reading. When students are reading, researchers mark the areas where students make mistakes and where they correct their mistakes. After that, the researcher calculates how many student errors, then converts into percentage and put into the
table IRI (Informal Reading Inventory) the word recognition (word recognition). Then, the researcher gave the problem (contains 10 comprehension questions) related to the text, the students are asked to solve the problem. Then the researcher corrected the students’ answer, calculated and converted into percentage, after that the result is inserted into the table of Informative Reading Inventory (Comprehension). From these two results, students can be categorized into independent levels, counseling levels and frustration levels. From the result of the grouping of reading ability, each group of reading ability was chosen randomly and selected all female, so that the difference of gender did not affect on this research.

The data of this study were collected using reading narration texts, the Ekwall and Shanker Informal Reading Inventory, problem solving task and interview guidelines. Ekwall and Shankel inventory is used to determine the level of student understanding. Ekwall&Shanker (1988) suggests that in order to make inventory read comprehension using the level of IRI (Informal Reading Inventory), certain instructions are needed, while elementary level students (starting level pre-school to Class I) using reading consisting of 20 to 40 words. The advanced levels (grade II and grade III) use readings ranging from 100 to 150 words and grade VII to grade VII using readings of 250 to 300 words. To measure reading comprehension, it usually uses questions about main ideas, important information, vocabulary and conclusions. Then the collected data were evaluated using a descriptive analysis method that is data condensing, data displaying and drawing and verifying conclusions.

3. Results

3.1 Findings related to reading abilities

| Students  | Reading abilities  | Detailed information about reading abilities                                                                 |
|-----------|-------------------|-------------------------------------------------------------------------------------------------------------|
| Nayla     | Independent Level | She can vocalize the text accurately, read the text loudly and rhythmical, she observed the punctuation accurately, when she read the text there was no evidence of lip movement and finger pointing; she read the text at the correct speed and with the correct intonation. She can accurately vocalize the words involved in the word recognition test. |
| Az-zahra  | Instructional Level | She can vocalize the text accurately, read the text loudly and rhythmical, she observed the punctuation accurately, when she read the text there was no evidence of lip movement and finger pointing; she read the text at the correct speed and with the correct intonation. She can’t accurately vocalize the words involved in the word recognition test. She made two mistakes in pronunciation. |
| Abilanissa| Frustration Level | She vocalized the text inaccurately, read the text slowly, abnormally, not rhythmical and read the text word by word. When she read the text, there was lip movement and finger pointing. She observed the punctuation inaccurately. She read the text with incorrect speed and incorrect intonation. She erroneously vocalized the words involved in the word recognition test. |

When students are reading, researcher are marking the areas where students make mistakes and where they correct their mistakes. After that, the researcher calculated how many student errors, then converts into percentage and put into the IRI table (Informal Reading Inventory) the word recognition (word recognition). Then, the researcher gives the problem (contains 10 comprehension questions) related to the text, the students are asked to do the problem. Then the researcher corrected the students’
answer, calculated and converted into percentage, after those processes the result is inserted into the table of Informative Reading Inventory (Comprehension).

3.2 Findings related to problem solving skills

Table 2. Finding related to problem solving skill when understanding the problem

| Students   | Detailed information when they understanding the problem |
|------------|----------------------------------------------------------|
| Nayla      | She understood the problem by reading the problem loudly, rhythmically and accurately, she observed the punctuation accurately, and read the text twice in order to understand the problem. She could present the problem’s idea verbally and based on her memory. She could identify what is required and asked in the problem shortly, clearly and use her language based on her memory. She could also use the reason why she wrote the information as what is known and asked. |
| Az-zahra   | She understood the problem by reading the problem loudly, rhythmically and accurately, she observe the punctuation accurately, has one wrong pronunciation and read the text twice in order to understand the problem. She could present the problem’s idea verbally suited to the script (see the script). She could identify what is required and asked in the problem according to the script and could also use the reason why she wrote the information as what is known and asked. |
| Abilanissa | She understands the problem by reading the problem slowly, non-rhythmically and inaccurately, she read the text word by word, she observed the punctuation inaccurately, had three wrong pronunciations and read the text twice in order to understand the problem. She could present the problem’s idea verbally suited to the script (see the script). She could identify what is required and asked in the problem according to the script and could also use the reason why she wrote the information as what is known and asked. |

Table 2 shows that Nayla and Az-zahra when understanding the problem, they read the text loudly, rhythmically and accurately and they observe the punctuation accurately. However, Abilanissa read the text slowly, non-rhythmically and inaccurately, she reads the text word by word and she observed punctuation inaccurately. Nayla could present the problem’s idea verbally and could identify what is required and asked in the problem shortly, clearly and used her language based on her memory. Az-zahra and Abilanissa could present the problem’s idea verbally and could identify what is required and asked in the problem.

Table 3. Finding related to problem solving skill when devising the plan

| Students   | Detailed information when they were devising the plan |
|------------|-------------------------------------------------------|
| Nayla      | She set out the steps to get the solution, then the she used the reason why choosing the strategy to solve the problem and she could give examples of other problems that can be solved with the same strategy. |
| Az-zahra   | She set out the steps to get the solution, then the she used the reason why choosing the strategy to solve the problem and she could give examples of other problems that can be solved with the same strategy. |
| Abilanissa | She set out steps to get the solution, but students were wrong in the first step. She made a mistake of transforming the mathematical language into a mathematical operation. She used the reason of why choosing the strategy to solve the problem, but the she could give examples of other problems that can be solved with the same strategy. |

Table 3 show that Nayla and Az-zahra when are devising the plan, they set out the steps to get the solution then they use the reasons why choosing the strategy to solve the problem and they can give the
examples for other problems that can be solved with the same strategy. Abilanissa set out the steps to
get the solution but the first step was wrong; she made a mistake in transforming the mathematical
language into a mathematical operation. She used the reason why choosing the strategy to solve the
problem, but she could give examples of other problems that can be solved with the same strategy.

Table 4. Finding related to problem solving skill when carrying out the plan

| Students  | Detailed information when they were carrying out the plan                                                                 |
|-----------|-------------------------------------------------------------------------------------------------------------------------|
| Nayla     | She applied the planned steps, then completed the necessary calculations in the planned step and set the final answer.     |
| Az-zahra  | She applied the planned steps, then completed the necessary calculations in the planned step and set the final answer.     |
| Abilanissa| She applied the planned steps, then complete the necessary calculations in the planned step and set the final answer, because in the first step, she had been planned incorrectly, the calculation and the final answer of the problem became wrong |

Table 4 shows that Nayla, Az-zahra and Abilanissa when are carrying out the plan, they apply the
planned steps then completed the necessary calculations in the planned step and set the final answer. But Abilanissa had a first step incorrectly, so the calculation and the final answer became wrong.

Table 5. Finding related to problem solving skill when looking back

| Students  | Detailed information when they are looking back                                                                 |
|-----------|-------------------------------------------------------------------------------------------------------------------------|
| Nayla     | She looked back the final answers obtained, looked back the precision of the steps that had been used and looked for other ways that might be used to solve the problem. |
| Az-zahra  | She looked back the final answers obtained, looked back the precision of the steps that had been used and looked for other ways that might be used to solve the problem. |
| Abilanissa| She looked back the final answers obtained, looked back the precision of the steps that have been used, but she did not look for other ways that might be used to solve the problem. |

Table 5 shows that Nayla and Az-zahra in looking back stage, they look back the final answers obtained, looked back the precision of the steps that have been used and look for other ways that might be used to solved the problem, but Abilanissa did not look for other ways that might be used to solve the problem.

4. Discussion

Basic reading skills are imparted to students in elementary school during the first grade. When students proceed through higher classes, acquired skills are developed further and higher skills are inculcated in students. A similar process is followed in the inculcation of mathematical skills. Here, it should be noted that the main skill to be imparted to students, both in mathematics and in all other academic disciplines, is that thinking; this can be realized by means of the language used by the students [4].

When understanding the problem, the students who had reading ability at independent level and instructional level had presented the problem’s idea verbally began with reading the text loudly, rhythmically and accurately, they observed the punctuation accurately, and read the text twice in order to understand the problem. She could accurately vocalize the words involved in the word recognition test. This is consistent with the characteristics of students who had the ability to read at the independent level presented by Johnson & Kress that is student who have reading ability at independent level read the text loudly, rhythmically and observe the punctuation accurately. The students with reading ability at frustration level presented the problem’s idea verbally began with reading the text slowly, abnormally,
non-rhythmically and read the text word by word. When she read the text, there was lip movement and finger pointing. She observed the punctuation inaccurate. She read the text with incorrect speed and incorrect intonation. She erroneously vocalized the words involved in the word recognition test [2].

Students with reading abilities at independent and instructional level can understand the problem, carry out the plan, devising the plan and looking back. Students whose reading abilities at the independent level is able to vocalize problems correctly and summarize what was given and required based on her memory, sure of their answers and able to try different ways of solving the problem. Students whose reading abilities at the frustration level, difficulties are experienced in terms of reading problem. These students were unable to make use of strategies during their problem solving performances. In addition, it can be argued that students were distracted while reading and solving the problem. They were not aware of the mistakes they which had been made while reading and problem solving.

The first step in solving mathematical problems is to understand the math problem itself. The connection between the ability of understanding and problem solving can be emphasized that, if one has the ability to understand mathematical concepts, then he is able to use them to solve problems. Conversely, if one can solve a problem, then the person must have the ability to understand the mathematical concepts that have been studied previously [3]. Students that experienced difficulties reading a problem was unable to provide correct answers. In addition, correct vocalization of the problem may not be enough for finding the correct solution to a problem, because the mathematical language involved in the problem must also be understood. There is also a need for students to develop strategies besides understanding the language of the problem and the mathematical language involved in the problem. Furthermore, to the development of strategies, how to administer these strategies to new situations must be mastered. Strengthening teacher-student and student-student relationships is of great importance for the understanding of problems [7]. Therefore, reading level and the problem solving skills of students should be handled together and instructional activities should be focused on the current teaching of these two skills.

5. Conclusion

It can be concluded that: (1) the students with independent reading ability when understanding the problem: reading the problem out loud, fluently and accurately, presenting the idea verbally based on their memory, identifying what is known and asked in a question briefly, clearly and based on their memory; when devising a plan: establishing steps to obtain a solution and using the reasons for choosing a strategy for solving the problem; When carrying out the plan: implementing the planned steps, completing the necessary calculations in the planned steps and establishing the final answer; When looking back: looking back the final answer obtained, looking back the precision of the steps that have been used and looking for other ways that might be used to solve the problem. (2) the students with instructional reading ability when understanding the problem: reading the problem out loud, fluently and accurately, presenting the idea verbally suited to the scripts test, identifying what is known and asked in a question briefly, clearly and suited to the script test; when devising a plan: establishing steps to obtain a solution and using the reasons for choosing a strategy for solving the problem; When carrying out the plan: implementing the planned steps, completing the necessary calculations in the planned steps and establishing the final answer; When looking back: looking back the final answer obtained, looking back the precision of the steps that have been used and looking for other ways that might be used to solve the problem. (3) Students with frustration reading ability when understanding the problem: reading the problem with soft voice, reading word by word and pointing finger, presenting the problem idea on verbally according to the script test, identifying what is known and asked in a question suited to the script test; when devising a plan: establishing steps to obtain a solution, but having errors in the first step and using the reasons for choosing a strategy for solving the problem; when carry out the plan: implementing the planned steps, completing the necessary calculations in the planned step and establishing the final answer of the question, but the final answer is wrong; when looking back: looking
back the final answer obtained, not checking the accuracy of the steps that have been used and looking for other ways that might be used to solve the problem

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