1. Exploration of Metacognitive

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Exploration of Metacognitive Ability at Elementary School Students in Learning Mathematics (Case Study in 1th Grade Students of Elementary School)

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Abstract

This study aimed to describe the representation of students' meta-cognition in math problems solving. The subject in this study was 1st grade students of elementary school in Sukasari Bandung which had the 8th and 9th rank in their class as many as 3 pairs. This was done with the consideration that the couple was at a critical ranked in the top 10 best-in-class. The data was collected through the journal school daily tasks, individual tasks, tasks in pairs (pair think aloud), deep-interview, observation with video recorder. The results showed that the development of meta-cognitive, motivation improvement and self-confidence, controlling cognitive process, endurance, specially verbally (Think-Aloud) may indirectly improve communication skills. Students need more guidance to reflect on their own thinking. Think Aloud usage can be tested on students who were at more mature stage of communication such as students at the level of middle and higher education. In addition, it was necessary to develop the validity of measurement instruments of *Adversity Quotient* in viewing the impact of the application of meta-cognitive strategy of think-aloud in learning mathematics.

Keywords: Metacognitive strategy of Think-Aloud, Math problem solving, Adversity quotient

1. Introduction

Some studies suggested that the ability of meta-cognition has been very necessary and related to the success of a student learning. Scraw [1] reinforce that build awareness among students that meta-cognition affect academic success. Sweney [2, p.1] obtained that some experts that meta-cognition is important, no doubt that academic success was influenced by aspects of meta-cognition abilities of a student, including in this case the success in solving math problems.

Meta-cognition is defined as awareness of "thinking about thinking" which means thinking about thinking. Swanson defines meta-cognition as "... the knowledge and control one has over's thinking and learning activities..." [3, p.1]. Meta-cognitive skills is the ability to control the learning process, from the planning phase, choosing the right strategy, as the issue at hand, and then monitor progress in learning and simultaneously correcting any errors that occur during understanding the concept, analyzing the effectiveness of the chosen strategy. Then reflect such change study habits and strategies if necessary, if it is deemed incompatible with the needs of the environment.

Meta-cognition strategies need to be trained and taught to students in mathematics learning process as early as possible, including at the elementary school students. There are a lot of meta-cognitive strategies that can be developed in the classroom, including: Toit et.al [4, p.58] explained that meta-cognitive strategies are Planning Strategy, generating question, choosing consciously, setting and pursuing goals, evaluating the way of thinking and acting, identifying the difficulty, paraphrasing and elaborating reflecting learners' ideas, clarifying learners terminology, problem-solving activities, thinking aloud, journal-keeping, cooperative learning, and modeling. Selection strategy must be done by considering the condition of the subject or the students. Sweeney explained that using many methods allow to obtain better results. "Researchers suggest that a multi-method assessment of meta-cognitive functioning may provide a more accurate picture of students' meta-cognitive functioning since varying methods do not share the same source of error" [3, p.25]

Based on the introduction above, researchers interested in assessing, exploring meta-cognition at elementary school with formulation of the problem in this research is “How is the representation of students' meta-cognition in solving math problems?”

2. Methodology

This was a case study. It is as the name suggests, concerned with a very specific instance of a phenomenon. It may be described as “a specific instance that is frequently designed to illustrate a more general principle”, “a case within educational research may be a child, a group, a class, a school or a community”

[5]. The case of this research was at a class in Sukasari Bandung elementary school. The subject of this study was 1st grade students of elementary school in Sukasari Bandung which has the 8th and 9th rank in class as many as three pairs. This was done with consideration of the couple is at a critical ranked in the top 10 best-in-class. The data was collected through the journal school daily tasks, giving individual tasks, tasks in pairs (pair think aloud) for an average of 60 minutes for 2 weeks. Students were interviewed to deepen the meta-cognition representation of individual and each pair of students in math problems solving. All stages of field notes and observations were done by using video recordings. Analysis and triangulation was performed simultaneously by descriptive exploratory data collection, with in-depth interviews (probing). Dyer said that the use of different instruments to gather data allows the case study to combine both subjective and objective descriptions.

3. Findings and Discussion

a. Journal (exercise assignment) of the school, in-depth interviews.

Based on the data collection, the exercise of journal assignment was given in school by teachers. The material was considered difficult for the subject of: to understand about filling pattern of jump numbers, the concept of tiered reduction down, sorting the numbers from the largest to the smallest, and word/picture math problem. The following images are subject journals that were categorized ugly and difficult.

Figure 1. Numbers Journal of Skip low value material

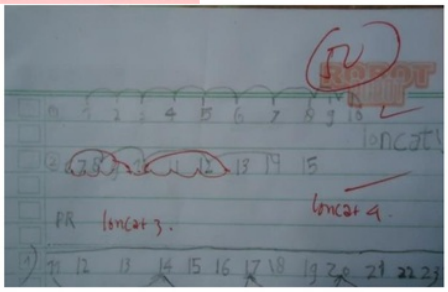
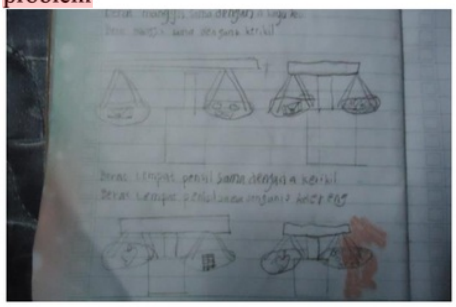


Figure 2. word/picture of math problem



After being identified the materials that were considered difficult, the researchers interviewed the subjects, in order to recall the memory back-related subject matter once to assess meta-cognitive representation.

Researchers gave the questions about what he felt, he knew why he felt hard on the material, and tried to teach him to find a strategy or solution from the hassle experienced. After he found the solution, try to teach him re-checking (looking back), asking the beliefs and attitudes of the material learned.

b. The task of the individual and in-depth interviews

The exercises consisted of the concept of numbers (10 items), a story about the concept of numbers (2 items), and the concepts of geometry and measurement (10 items). After giving the case to the subject of research, then the subject should complete the practice questions within no more than 10 minutes.

The findings for the subjects of geometry and measurement, the students can finish without any constraints. However, for the matter of the representation of an image scales to determine which was more severe and mild in terms of the story, the subject had difficulty in answering any of these questions, the answers produced one. The question is: Rice is placed on the left side of the scales, and sugar placed on the right side of the scales. Having weighed the lower right-hand side, which is more severe rice or sugar?.

Researchers think the fair was considered a difficult matter, because of the analysis of the subject exercises ledger journal, the researchers did not find examples of exercises that discuss about the story. Training was provided directly by loading the image equilibrium above: Figure 2. word/picture math problem. Researchers had more depth interviews to help students link the information he had in resolving the matter.

In the process of exploring meta-cognitive, the subject in question arrange calculation summation, the researchers noticed that the subject of repeated checking of the results obtained, as well as to the reduction of tiered downwards, the subject repeats the calculation process, the subject of the statement above that "should be re-examined mom ... should not rush, should be carefully re ...", researchers can see the emergence of self control in solving mathematical problems. Besides the subject can use existing resources, it performs calculations with fingers, then resume the calculation by way of a short tiered, indirectly the subject can choose the right strategy in solving problems and controlling the process. It is appropriate that Scoenfeld had the opinion that meta-cognition is a habit in controlling the process of cognitive behavior, "Control or self-monitoring of one's thought processes" [7].

From the interview above, it was also shown that meta-cognitive had an impact on students' fighting spirit (Adversity Quotient) through the control of the difficulties encountered, and try to resolve the problem by not despair. This is one indicator of the ability of the power struggle developed by Stolz [8]. Dimensional controls with regard to a person's response to adversity, either slow or spontaneous. It certainly should be analyzed in depth by using a valid measurement instrument.

c. Task Pair (Pair-Think Aloud).

Think-aloud is a research method in which participants speak aloud any words in their mind as they complete a task [9]. After giving some time mentoring individually and explore meta-cognitive, researchers expand by providing opportunities to the three subject (first subject) in pairs with three other subject (second subject) to complete the subject matter. The second subject was not previously given guidance on the subject meta-cognition as the previous one.

Researchers assumed that subject 1 already had enough experience of meta-cognitive development in problem solving. Then, we expected subject 1 can develop a meta-cognitive by providing questions and or reason to the subject 2 and finish the matter in pairs. The researchers gave direction to the two subjects to solve problems together (think both of them), each question why?, answer what next? as such, whether it was correct or not settled by them.

Then, the observation data, field notes and viewing the recorded video were analyzed. The result was in accordance with the alleged investigators, interaction between the two subjects were not very active, the subjects tended to work each (individual) during the process, the researchers re-submitted two subjects to work together, not individually, but to avoid interference from, so that was delivered with the language inviting.

Subject 1 tried to match the answer to the second subject, if there was a difference, then the subject 1 and subject 2 asked why such a result? but not so with the subject 2. The control of meta-cognitive was dominated by the subject 1. Subject 1 required shorter time to complete than the subject 2. So when the first subject wanted to ask for results and asked, the first subjects had to wait first few moments. Subject 1 looked fast in calculations and do a re-examination.

It could have been predicted by the researchers, because the subject 1 has been getting assistance in developing meta-cognitive then it was begun in internalizing the use of meta-cognitive skills. Whereas subject 2 has not received assistance, so this is a recommendation of this research, it is important to do the development of students' meta-cognitive awareness of what is known, what is to be done, why, and so on. thus mathematical communication skills, students can simultaneously be developed. It is difficult to develop meta-cognitive skills in pairs in grade 1 primary school, researchers still give a warning and encouragement throughout the process. However, this can enhance a positive learning interaction, self-confidence, of course, the ability of meta-cognition in cognitive control.

4. Conclusion

Meta-cognition helps students' awareness of the thinking, control of cognitive processes and increase self-confidence, sharpen fighting spirit (adversity Quotient). To develop meta-cognitive in verbal (think-aloud) can indirectly improve communication skills. This suggests that students need more guidance to reflect on their own thinking with verbalization.

For other researchers can try to use Think-Aloud meta-cognitive strategy in the teaching of mathematics at middle and higher education. It is a need to develop a valid instrument to measure math problem solving ability, Adversity Quotient for mathematics students to see the effect of the application of meta-cognitive strategy of think-aloud.

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