Students’ Self-Monitoring on Mathematics Ability: Cube and Cuboid Problem Solving

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Abstract. This study aims at describing students’ activity to understand the behaviors processes called self-monitoring in a cube and cuboid problem solving viewed from mathematics ability. The subjects were eight graders of junior high school who studied surface area and volume of cube and cuboid classified into high, average and low mathematics abilities. Mathematics ability test to select the subjects the study. Data were collected through self-monitoring task and interviews. Data triangulation was used to verify the credibility findings. Data analysis was done by data condensation, data display and conclusion drawing and verification. Results showed that students’ self-monitoring with high math ability is more fulfilled self-monitoring components. Students with average and low math abilities not fulfilled the component that covers verifying the results during solving the problem. It is expected that teachers must provide different learning treatments to improve students’ self-monitoring for better learning outcomes.

1. Introduction
Self-monitoring is the students’ activity in systematic way to understand the behavior and the thinking process that did in problem solving. Students have difference expressions and behavioral settings in learning. So, important for students to be done self-monitoring [1]. Each student must be able to determine of the personally problem solving during the learning process by reducing the teacher’s intervention. Students should be cognitively aware of what they will do, what they should do, why they do and what outcomes will be made if done. Self-monitoring is needed to improve the function of independence learning in order to achieve maximum learning outcomes. Personal behavior monitoring of activity in a professional and systematic way will improve learning outcomes [2]. Learning outcomes is a description of student mastery in mathematics through the mathematics learning process. That called ability [3]. Self-monitoring of students problems solving consist of the components reading and understanding information, analyzing and planning strategies, implementing and monitoring strategies used, verifying and ensuring that they have used every step of the activity [4].

There were a significant difference between the results of the students' mathematics skills that reinforced by giving a similar sample to those using self-monitoring from preparation to implementation and similar problem solving investigations [5]. Self-monitoring will help students acquire knowledge, improve generalization and transfer knowledge and skills to achieve students learning success [6]. But the two studies did not reveal how the complete description of self-monitoring students in solving problems in cubes and cuboid viewed on differences in students' math abilities. There are three categories mathematical abilities namely high, average and low [7].
Based on the problems, researchers interested in knowing the profile of students self-monitoring in a cube and cuboid problem solving viewed on mathematical ability. Research subjects are junior high school students who have been able to solve cube and cuboid that can study abstract material such as mathematics [8]. In this study, interviews was used to find out students self-monitoring performed after completing the self-monitoring task that contains a cube and cuboid problem. Interview results show that students with high math ability through all components of self-monitoring. Student with average math ability are not performing verification activities and students with low math ability do not verifying and do not making sure they have used every step of the activity. This means that students with high math ability perform self-monitoring activities more complex than students with other abilities. The impact of a more complex self-monitoring implementation makes students with high math ability able to solve problems more precisely. Therefore, teachers can give extra attention to students with low and average math ability to be able to train their self-monitoring so as to obtain better problem solving results.

2. Method
The study is a qualitative research that aims to describe students self-monitoring in a cube and cuboid problems solving on differences student abilities. The instrument is a mathematical ability test consisting of 5 essay questions, self-monitoring tasks of students used to obtain student's self-monitoring data, and interview used to collect the corresponding data of students self-monitoring more deeply. Interviews were conducted after the students completed the self-monitoring cube and cuboid task.

Mathematical ability test was given to 32 eight graders students who had studied previous cubes and cuboid. Data on mathematical ability test results are used to select subjects three subjects with high, average and low math abilities. Each subject was given self-monitoring tasks and then interviewed. Data triangulation was done to verify the credibility of the findings. Data analysis was done include data condensation, data display and conclusions drawing and verification [9]. The whole research procedures include preparation phase, implementation phase, data analysis and report writing phase.

3. Results and Discussion

3.1. Students Self-Monitoring on High Mathematics Ability
Subjects self-monitoring on high mathematical ability in reading and understanding information components appears reading the problem five times to understand the problem. The subject expresses her understanding of the problem by writing the known and questions in the answer sheet using his own language which is different from the language of the question. The subject emphasizes her understanding by telling about the complete problem and command the problem to be resolved. Subjects use information in a known matter that includes length, width, height and sides, then formulates it to answer questions.

Self-monitoring subjects in analyzing and planning strategies components seen in detecting experiences that have been previously owned when elementary about cube and cuboid. Subjects use other information relating to the problem that is the formula of the cube and cuboid, and trying to change the unit as expected by the problem. The subject tries to solve the problem with a different strategy by first changing the unit for self-monitoring task 1 and by using the cube and cuboid formula for self-monitoring task 2.

Subjects self-monitoring in implementing and monitoring the strategy components emerged when planning the solution step that will be used is to change the unit first, but there are obstacles, then proceed with the preparation of a new plan that is by change the way used. The subject will get a solution if it is at a certain step. Subjects have also made mistakes in problems solving in the form of mistakes to change units and calculations but then fix the error. Subjects make corrections to each step of work with the goal of denying to themselves that there is no mistake her made. The subject is
rethinking the steps that have been taken and the results that have been obtained to ensuring the correct answers obtained.

Subjects self-monitoring in the verifies component when finding and changing answers that are considered unreasonable. Subjects try different ways that have been written with the aim of supporting or comparing with the solution that has been obtained.

Subjects self-monitoring in ensuring it has used every lagkah of activity components appears on the activity of correcting the calculations until repeating them to ensuring that the results obtained are the correct result. The subject also shows the suitability between the problem and the results obtained through the examination of the solution steps.

Based on the activities that have been done, then the data of subjects self-monitoring on high math ability in cube and cuboid problem solving can be presented in figure 1.

![Figure 1. Subject Self-Monitoring on High Mathematics Ability](image)

**3.2. Subject Self-Monitoring on Average Mathematics Ability**

Subjects self-monitoring on average mathematics ability in reading and understanding informations components of information visible when reading the problem more than once or even five times to understand the problem and to solve it. Subjects express problems using their own words based on comprehension include known and asked. The known stringing subjects such as length, width, height and sides to answer are asked by searching the volume of cubes and cuboid.

Subjects self-monitoring in analyzing and planning strategies components are seen in the activity of detecting previous experiences about finding the area and volume of cubes and cuboid. The subject utilizes the known on the problem and computes it with the formula of the area and volume of cubes and cuboid. The subject tries two different ways and chooses one answer that is considered to have a more appropriate way.

Subjects self-monitoring in implementing and monitoring strategies components emerged when planning, executing plans and then proceeding with completion in accordance with the initial solution plan. The subject is aware made quite a few mistakes so that the subject has to correct the error. The subject believes the answers that have been obtained because having made corrections to the solution steps.

Subject self-monitoring in ensuring used every step of the plan component appears on the activity of examination of the calculation to believe the answers have been obtained. The subject examining completion steps and conformity between the questions and the results obtained.

Based on the activities that have been done, then the data of subject self-monitoring on average math ability in cubes and cuboid problem solving can be presented in Figure 2.
3.3. Subject Self-Monitoring on Low Mathematics Ability

Subjects self-monitoring on low mathematical ability in the reading and understanding information component appear when reading more than one question when doing a problem, while and after completion. Subjects use information that is known in the question of length, width, height and cube sides to be formulated in answering the problem.

Subjects self-monitoring on analyzing and planning strategies component is seen in the activity of detecting previous experiences about finding the area and volume of cubes and cuboid that is at the time of the primary and when given first self-monitoring tasks. Subjects using and associate the volume, area and circumference formula with the information in question.

Subjects self-monitoring in implementing and monitoring strategies component arises when knowing has made a mistake and then corrected the error. The subject then proceeds by correcting steps that have been taken during the completion.

Based on activities that have been done, then the data of the subjects self-monitoring on low mathematical ability in cubes and cuboid problem solving can be presented in Figure 3.

4. Conclusion

Based on the research findings and analyzing, concluded that students with high mathematical ability perform all self-monitoring activities components include reading and understanding, analyzing and planning strategies, implementing and monitoring strategies used, verifying and ensuring used every step of the activity. Students with average math ability showed self-monitoring activities components include reading and understanding, analyzing and planning strategies, implementing and monitoring strategies used and ensuring used every step of the activity but not verifying the problem. Whereas students self-monitoring on low math ability perform activities components include reading and understanding, analyzing and planning strategies, implementing and monitoring strategies used, but does not perform verification and ensuring used every step of the activity.
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