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Analysis of Students Metacognitive Skill in Solving Problem on Guided Inquiry Learning Model

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Abstract

Metacognitive skill is fundamental in achieving understanding of science concepts and developing problem solving skills. Guided inquiry learning model can develop metacognition and problem solving skill. Research was conducted by mix method approach and concurrent triangulation strategy. The purpose of this study is to analyze metacognition and problem solving skills and analyze the relationship between metacognition skills and problem solving abilities after following the guided inquiry learning models. The result showed that 72,2% of students had metacognitive skill with growing very well category, and 27,8% belong to the category well developed. The most dominant component of metacognition is planning with subcomponent determine goal of problem. According to the result of problem solving test, it shows that the most students included in the good category (44,4%), the most dominant indicator is understanding the problem.

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INTRODUCTION

The core competency of the 2013 curriculum requires that students have metacognition and problem solving skills. Metacognition skills are thinking skills, knowing what we know and what we don't know, learning how to learn and developing a continuous thinking process where this can be used to solve problems. Metacognition skills consist of planning skills, monitoring skills, and evaluation skills (Aprilia & Sugiarto, 2013). To solve problems, students need to understand how their mind functions (Downing, 2009), or it can be said that solving problems requires metacognitive abilities.

Maretasani & Dwijanto (2016) said that in order to improve students' problem solving and metacognition skills is needed the learning that provides opportunities for students to gain as much experience as possible to solve problems and through these activities students practice to build their own knowledge, use various problem-solving strategies, organize and realize the thought process.

Dawson & Fuhcer (Laurens, 2011) said that students who use metacognitive well will be critical thinkers, good problem solvers, and good decision makers than students who do not use their metacognisation. Metacognitive ability plays an important role in science learning as an effort to deal with everyday life, including metacognition that plays an important role in learning, motivation, critical thinking, problem solving, and meaningful learning activities.

Inquiry learning (inquiry) is a learning with a series of activities that emphasize the process of critical thinking and analytical to find and find out for themselves the answers to a problem in question (Sanjaya, 2006). Through this inquiry learning, including guided inquiry learning learners are not only able to develop problem-solving abilities, but also accompanied by the development and use metacognition skills. This is because in the implementation of inquiry learning demands the active role of students as well as the use of metacognitive strategies in implementing the learning (Aprilia & Sugiarto, 2013). Syarifuddin & Sugiarto (2012) also stated that there was an increase in students' self-metacognition abilities after applying guided inquiry learning on the buffer solution material. In addition, Corebima (2009) also states that inquiry is a learning strategy that has the highest effect on students' metacognitive abilities.

Metacognitive awareness and problem solving are not formed by themselves without encouragement and teacher facilities. According to Jayapraba (2013), teachers have a significant role in forming student metacognition. However, Djuanda (2014) argues that many teachers do not understand metacognition so they have not taught or conducted learning activities that encourage and develop metacognitive skills consciously and plannedly. This is in accordance with the results of interviews and observations with science teachers in SMP Negeri 2 Bumiayu, Brebes. The science teacher knows about metacognition, but does not know how to apply it to learning. Learning that has been done emphasizes less on developing metacognition skills and problem solving for students. Practical activities that have been carried out tend to think of the final results of a problem or problem so that students are less able to solve problems with correct and logical procedures. Initial knowledge and understanding of students' concepts are not used properly in the learning process.

The importance of metacognition and problem-solving skills in self-learners that are applied in secondary schools, the researchers analyzed more about metacognition skills in problem solving IPA on the theme of light and optical devices. This study aims to determine how metacognition skills of students in solving problems that exist in science learning through guided inquiry learning models.

METHODS

The study was conducted at SMP Negeri 2 Bumiayu on Light and Optical Device theme. The research was conducted with mix method approach and concurrent strategy triangulation. Research design used is one group pretest and posttest. The population in this study were

students of class VIII SMP Negeri 2 Bumiayu academic year 2017/2018. The sample in this study determined by purposive random technique sampling which is a combination of sampling quantitative and qualitative (Creswell, 2014), refers to advice from the science teacher on the spot research and pay attention to distribution and homogeneity of the population. Samples taken 1 class is class VIII I. refers to the advice of the science teacher at the research site and paying attention to the distribution and homogeneity of the population. Samples were taken in 1 class (VIII I).

The independent variable in this study is guided inquiry based problem solving learning, the dependent variable is the students' metacognition and problem solving skills, and the control variables in this study are subject matter, curriculum, and the number of lesson hours.

Data collection techniques used include test techniques, questionnaires, observation, interviews, and documentation. The test method is used to obtain problem solving capabilities data. Observation methods, questionnaires and interviews were used to find out students' metacognition skills data. The instrument used is a test script in the form of a description that is integrated with indicators of problem solving abilities. Another instrument is the metacognition skills questionnaire adapted from the Metacognitive Activities Inventory/MCA-I (Cooper et al., 2008), interview guidelines, and learning tools which include syllabus, lesson plans and worksheets that are adapted to the 2013 curriculum.

Research is carried out in stages that is the implementation of the pre test includes written test questions a description of the Light and Optical Device as well as filling in the skills questionnaire metacognition, the application of a guided inquiry model, and post-test implementation which includes activities such as the implementation of pretest. Data analysis carried out quantitatively and qualitatively. Quantitative data analysis includes testing normality, homogeneity test, and hypothesis testing. Hypothesis testing consists of N-gain test, t test and product moment correlation test. Qualitative analysis is the description of the results of written tests, observations and interviews. Conclusion of research results by considering all the results of quantitative and qualitative data analysis.

RESULTS AND DISCUSSION

Metacognition skills and problem solving abilities of students in light and optical devices material were seen based on the results of metacognition skills questionnaire (MCA-I), interviews, observations during learning, and the results of written tests. The results of filling out questionnaires given to students showed that the average score of metacognition skills increased from 72 to 82. The increase in the average score of metacognition skills can also be seen based on the value of the N-gain test of 0.386 with the medium category. Based on the results of the significance test through the t test obtained tcount = 8.176 and t table = 2.032. It can be concluded that there are significant differences between the results of pretest and posttest metacognitive skills of students.

Increasing the score of metacognition skills in this study can not be separated from the influence of the application of guided inquiry learning models. In line with some previous research, as disclosed Aprilia & Sugiarto (2013) in his research that the learners have metacognitive skills after the implementation of guided inquiry learning models (guided inquiry) on the salt hydrolysis theme. Syarifuddin & Sugiarto (2012) also stated that there was an increase in the students' self-metacognition ability after applying guided inquiry learning on the buffer solution material. Additionally, Corebima (2009) states that the inquiry (the inquiry) is a learning strategy that has the highest effect on the ability of learners' metacognition.

Metacognition skills are also analyzed from each component of metacognisation which consists of planning skills, monitoring ability, and evaluation skills. Each of these components can be seen based on each answer in each item stated in the MCA-I questionnaire. The results of the analysis can be seen in Figure 1.

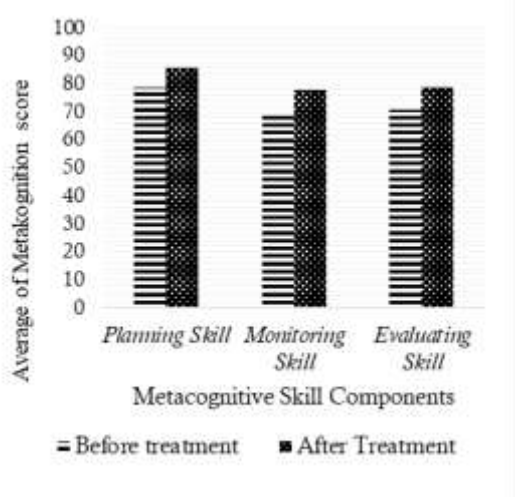

Figure 1. Average of Metacognition Skill Score Before and After Treatment

The results of the MCA-I questionnaire analysis showed that the most dominant component of metacognition was the planning component, namely with an average score of 86%, while the metacognition component with the lowest average score was the monitoring component which was 78%. Based on the N-gain test, the average N-gain value of the metacognition indicator is 0.36 with the medium category.

Planning capabilities can be built through indicators of metacognition skills, namely determining the purpose of the problem, accessing information underlying the problem, allocating resources that are the background of the problem, allocating resources that can be used for problem solving, and budgeting time. Planning capability has been trained by the teacher during learning activities with guided inquiry models. In problem solving activities students are asked to explore problems, discuss with groups, and look for various sources to solve the problem. Students are given the widest opportunity to access information related to planning to solve problems, so that when working on writing students are used to it. Jordan (2011) states that planning refers to the actions of students before solving problems, including including determining the objectives of the problem, identifying information relating to the problem, and making a plan to solve the problem.

The component of metacognition which obtained the lowest average score, namely monitoring. This is due to a lack of understanding of material related to many concepts. If the concepts of students are low, the learning outcomes will be low. Monitoring can be interpreted as awareness in carrying out tasks as a whole. Actions that describe this skill when solving problems include analysis, linking and applying knowledge to solve problems, sorting, organizing, and mapping related to problems.

The questionnaire consisted of 8 indicators of metacognition skills. The results of the indicator score analysis of metacognition skills are presented in Figure 2.

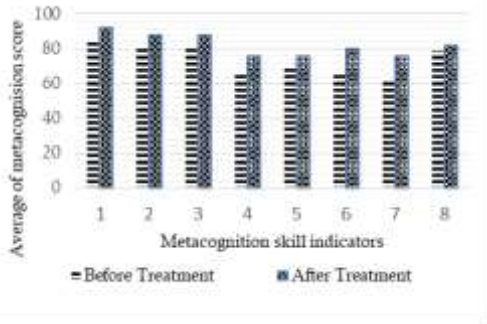

Figure 2. Average Score of Metacognition Skill Indicator

Information:

Indicator 1	: Determine the purpose of the problem
Indicator 2	: Access background information
Indicator 3	: Allocate sources
Indicator 4	: Budgeting time
Indicator 5	: Self testing
Indicator 6	: Comprehension of task performance
Indicator 7	: Appraise product
Indicator 8	: Re-evaluate goal and conclusion

Problem Solving Abilities of Students

Aspects of problem solving abilities analyzed in the study are; 1) understanding the problem; 2) planning problem solving; 3) implement a problem solving plan, and; 4) evaluation. Data on problem solving skills were

obtained from the results of the written test of the pretest and posttest. Test instruments are in the form of description questions with a total of 15 questions that are integrated with indicators of problem solving abilities.

The average score of problem solving abilities increased from 44 to 72. Increasing the average score of problem solving skills can also be seen based on the N-gain test value of 0.64 with the medium category. Significance test through t test obtained by tcount = 19,055 and t table = 2,032. It can be concluded that there are significant differences between the pretest and posttest results of students' problem solving abilities. The concept that is built by students through investigation, discussion and problem solving is able to develop students' metacognition. This is in accordance with the opinion of Downing, et al (2009) stating that problem-based learning can be used by teachers to achieve metacognitive goals in learning.

Problem solving abilities are also analyzed from each indicator consisting of understanding the problem, planning problem solving, implementing a problem solving plan, and evaluating. Each indicator can be seen based on each answer on each question listed in the problem solving ability test questions. The results of the analysis can be seen in Figure 3.

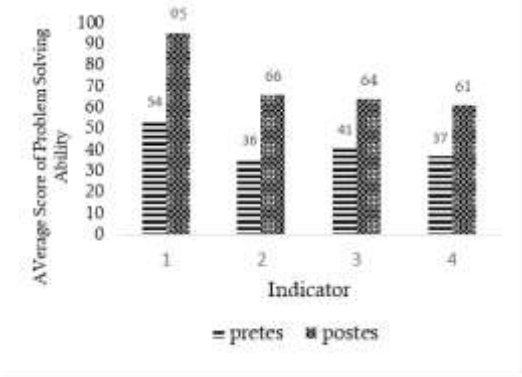

Figure 3. Average Score of Pre-test and Post-test Problem Solving Ability

Relationship between Metacognition Skills and Problem Solving Abilities

The third hypothesis test is to find out the relationship between the variables of metacognition skills and problem solving skills using product moment correlation test. The data used to analyze the relationship between variables using written test data problem solving ability and metacognition questionnaire. Based on the results of calculations obtained product moment correlation value of 0.88. Furthermore, the significance level at alpha 0.05 is calculated that Ho is rejected, which means there is a significant relationship between metacognition skills and problem solving abilities.

From the 36 students, 15 students were taken randomly based on class ranking. Classes are divided into three levels, namely high, medium and low groups, each of which is taken by each group of 5 students. The results of the analysis showed that the metacognition skills in the high class were four students who were included in the very good developing category, and 1 student included in the category had developed well. While the problem solving abilities of students in the high class are included in the excellent category. Metacognition skills of students in the middle class included in the category have developed well and the problem solving abilities are included in the excellent category. In the low class, there are two students with metacognition skills that are well developed and three students with metacognitive skills begin to develop. Whereas for problem solving abilities low group students are included in the good category.

There are two categories of metacognitive skills of students in this study after participating in guided inquiry model learning, which is developing very well and has been well developed. Students who have metacognitive skills develop very well, meaning that students are able to use their metachogical skills regularly to organize their own thinking and learning processes. Aware of the many kinds of possibilities of thinking or in this case aware of many possible ways to solve problems that must be solved, able to use the possibility of thinking or various ways to solve the problem with the problem, and be able to reflect the process of thinking. Students with their metacognisal skills are in a well-developed category, meaning that students are aware of their own thinking

processes and can distinguish between the stages of elaboration input and their own thought output.

Students who are in the high and medium group have metacognitive skills with very good developing categories and very good, good and good problem-solving abilities, are able to do problem solving well which can be seen from the results of working on problem solving ability test questions in the form of integrated descriptions with components of metacognition skills. High and middle class students alike provide good problem solving, but high-class students tend to provide more complete problem solvingwhen compared to medium groups even with students in low groups. Completeness of problem solving can be seen from the completion of all questions on the problem solving ability test and the steps of practical activities.

This finding is in line with the results of the study stating that the learning outcomes of students who have a high level of metacognition skills are better when compared to students who have a low level of metacognitive skills (Copper et al., 2008; Pulmones, 2007). This is because the use of good metacognition skills will be able to guide cognitive activities when solving problems, so that the thinking process carried out by students in solving problems becomes more effective (Davidson et al., 1995).

When confirming through interviews regarding the results of student problem solving that have been conducted and associated with filling out the questionnaire on metacognition skills, it was found that high group students gave a harmonious assessment of what had been done in solving the problem by filling out the questionnaire. While students in the medium and low groups tend to give a good assessment of themselves regarding the use of metacognition skills in problem solving, but do not look maximal in the use of metacognition skills in solving problems.

Regarding the bias in the discrepancies of self-assessment conducted by students, Metcalfe (1998) states that such discrepancies occur because people usually choose choices that they think are the most reasonable and are the optimal choice in self assessment, so that there is a failure to recognize that someone has weak skills or abilities, and will produce the opinion that someone has good skills or abilities. As a result, someone who is incompentent tends to overestimate their skills. The existence of several self-assessment discrepancies made by students in filling out the metacognition skills questionnaire resulted in students' metacognition skills not only being measured by filling out questionnaires in metacognition skills, but also directly seen from the results of problem solving by students. The results obtained from the two instruments were also reconfirmed through interviewing students to find out the truth, not to change the data that had been obtained.

In general, it can be concluded that students with high metacognition skills which are included in the category of developing very well and have developed well are able to solve the problems contained in the test questions effectively and efficiently so that the test results obtained in the category of very good and good. In addition, students who have high metacognition skills are better able to understand the concept, compared to students with a pregnancy of metacognition in the category starting to develop. Students who have the value of problem-solving abilities that are not in harmony with their metacogical skills are caused by students assessing their metacognisation skills higher or lower than their performance in solving problems from the test questions given.

CONCLUSION

Amounting to 72.2% of learners have metacognitive skills with excellent growing category, and 27.8% included in the category is already well developed. The most dominant component of metacognition is planning with subcomponents to determine the objectives of the problem statement

Problem solving ability shows that most students have problem solving abilities with good categories (44.4%), the most dominant indicator of which is understanding problems.

Based on the results of calculations obtained product moment correlation value of 0.88. Furthermore, the significance level at alpha 0.05 is calculated that ho is rejected which means there is a significant relationship between metacognition skills and problem solving abilities.

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