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The students' metacognition analysis through jumping task based on lesson study for learning community

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Abstract. This research aimed to analyze the students' metacognition through jumping task based on lesson study for the learning community. This research is qualitative descriptive research. Data collection was done by observation, tests, interviews, think aloud and documentation. The test was given to students when an open class in class VIII of MTs Miftahul Hidayah. From the test results, students were grouped into three based on their level of ability. Two students were selected from each group to be interviewed and deepened through thinking aloud technique. Two students were selected from each group to be interviewed and deepened through thinking aloud technique. Data analysis is in the form of data induction and reduction theory. The results showed that students who had good metacognitive knowledge skills became effective and efficient when they were applying metacognitive control skills. Hence, the students who had poor metacognitive knowledge skills, they experienced difficulties when they were applying metacognitive control skills. The contribution of jumping tasks based on lesson study for learning community is very helpful in enhancing students' metacognition abilities and skills to individually, in groups and classically.

1. Introduction

Mathematics as one of the subjects holds a significant role in education. Mathematics is a means of thinking to develop the reasoning power, logical, systematic, and critical thinking [1]. However, for mathematics learning problems, among them are the students' difficulty, teacher's constraints and limitations of educational facilities. From some of the students' difficulties, especially on operations material of the algebraic forms can be simplified into three groups that are the lack of prerequisite material, error concept, and error procedure.

The effort that can be made is to understand the difficulties which are experienced by the students in learning mathematical concepts, how the students learn, the comprehending process and the steps of their learning as well as how the students think about their thinking processes. It is generally known as metacognition, is a term introduced by John Flavell, a developmental psychologist from Stanford University. Metacognition is a high-level thinking process that is responsible for active control over the cognitive processes [2]. In the journal, Afifah mentions metacognition is an awareness of cognitive students, how it works, and how to set them up. This development is very important especially for the purposes of students' efficient cognitive use in completing the problem [3].

Mahdavi states that nowadays the majority of researchers have been conceptualizing metacognition to have two main components, those are metacognitive knowledge and metacognitive control. Metacognitive knowledge consists of three closely related aspects that are: 1) Declarative knowledge,

it is the knowledge, skills, and important strategies to accomplish the task successfully in all sorts of conditions. 2) Procedural knowledge, it is the knowledge of how to implement the learning procedure such as learning strategies or actions to use the declarative knowledge in achieving goals. 3) Conditional knowledge, it is referred to knowledge about when and why to apply various procedures, skills, and actions or cognitive strategies. Meanwhile, metacognitive control is the second major element of metacognition to control their own learning or thinking. This includes at least three important aspects, namely: 1) Planning, including the election of appropriate strategy and predictions to achieve the objectives. 2) Monitoring, referring to a critical analysis of the effectiveness of the strategy or plan which is being implemented. 3) Evaluation, referring to a progress examination that is being made towards the objectives that can trigger the planning, monitoring and further evaluation [4].

Metacognition is a mental activity which cannot be taught but can be embedded in learning or coaching. The thinking process usually occurs when learning activities take place so that metacognition ability is closely related to students' learning activities [5]. Learning activities in the classroom involve the ability of the students' diverse understandings. Therefore, it needs to be designed a learning process using two types of tasks that are sharing task and jumping task. Sharing task is a task at the students' level or students can still reach out to solve them. While jumping task is a type of task which is given with the purpose is enabling the students to think more critically and challenging so that students will experience a leap of learning to encourage them to think harder and get something of what is learned [6].

The superiority of jumping task method is able to create learning activities among the students such as effective dialogue, interaction and collaboration [7]. Through the jumping task, the students are taught to think independently and grow with their peers. Through a creative learning process which is based on learning community and giving priority to dialogue in the activity of learning, the school guarantees the right of each child's learning, develops solid academic skills and fosters children who are able to think independently and able to grow with their peers [8].

The implementation of jumping task method can be developed through Lesson Study for Learning Community (LSLC). Lesson study is scientific activities for teachers who are trying to develop their theory to develop and share good practices [9]. On lesson study, the teachers collaborate to study the learning content and instruction by observing the lesson and discussing it. Through such approaches, they try to improve the quality of their teaching [10]. Learning-community itself is a result of lesson study, to improve the students' learning activities so that it can cooperate in the form of collaborations and collegiality [11]. Therefore, the application of the lesson study at present is developed in the learning community. Generally, it is called the LSLC (Lesson Study for Learning Community) [8]. The stages of lesson study can be described as a process: plan, do and see [12]. The application of lesson study for learning community can be specified as follows: (1) the application of Collaborative Learning and Caring Community-Based Learning, (2) the application of Learning Community-Based Learning, (3) the application of a Jumping Task-Based Learning, and (4) the use of Students' Worksheet based Scientific Approach [13].

It can be inferred that the analysis of the students' metacognition to explain the students' metacognition skills based on the components of metacognition is in the form of metacognition knowledge and metacognition control. Through the jumping task is expected that the students feel more challenged to learn better, create dialogue, interaction and collaboration learning activities and also train to think independently and creatively. The implementation of lesson study for learning community in learning uses the collaborative model so that the students can learn and interact through the learning media. Then teacher collaboratively does study towards learning that is implemented.

The previous researches, Herawaty, et al., (2018) aimed to describe the students' metacognition in solving problems using mathematical problem-based learning in Rejang Lebong ethnomathematics [14]. Rimbatmojo, et al., (2017) conducted research to find out the difficulties of the students' metacognition for resolving open problems in mathematics [15]. Hobri, et al., (2018) analyzing the students' metacognition skills through the application of mathematical problem-solving learning based on Lesson Study for Learning Community [16]. While this research aimed to analyze the students'

metacognition through jumping task based on lesson study for learning community.

2. Research Methods

This research was descriptive qualitative research. The method used was a case study that is the part of qualitative methods to explore a particular case in greater depth by involving the collection of various information sources [17]. In this study, the case which was going to be explored was the difficulty about the algebraic forms material that was revealed by performing students' metacognition analysis through jumping task based on lesson study for learning community.

Data collection were done by observation, test, interview, think aloud and documentation. The observation was done at each stage of lesson study that was Plan, Do and See. In the stage of Plan was making the lesson plan and the students' worksheet with the model teacher. The stage of Do was done in the open class of the student's activities. In the stage of See was done the reflection towards the learning process when the open class. The test was given to the students when the open class in VIII class MTs Miftahul Hidayah. From the results of the test, the students were grouped into three levels based on their abilities. Two students were selected from each group to be interviewed and deepened through the think aloud technique. Meanwhile, the documentation was to record all activities at each stage of the lesson study. Data analysis was done descriptively qualitatively, in the form of data induction and reduction theory.

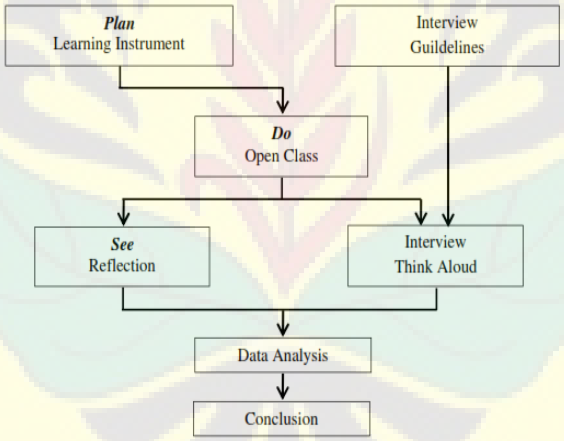

Figure 1. Research Design

3. Results and Discussion

The stage of the application of the lesson study for learning community is begun with a plan. At this stage is done the formulation of learning strategies and learning instruments in the form of the lesson plan and the students' worksheet. This instrument is expected to increase the students' activities so that they can work together in achieving the learning objectives. There are four people following this stage, they are mathematics teachers of class VIII as the model teacher, while the two other subjects teachers and researcher as the observers. The model teacher describes the plan of the learning process to the observer.

In the open class, the model teacher implements the learning process in the classroom with the material is operations of algebraic forms. While the two other subjects teachers and researcher conduct observations by using observation instruments on the student's activities. Open class is one of the activities of LSLC which is continued by reflection of the students' activities observation result [18].

The last stage is the reflection of the learning process by reporting the results of the observation. Reflection is the "see" stage in LSLC which focused on how the students learn, while the observation on how the teacher teaches as well as the learning material mastery would be given a very small percentage [18]. All observers report the results of their observations and the conclusion stated that teachers are greatly helped in the learning process by the help of the lesson plan and the students'

worksheet, while the students showed activities in the form of cooperation, discussion and helped each other in one group.

In this research, the test given consisted of sharing task and jumping task of algebraic form operations material. From the results of the test given to the students in the open class of class VIII MTs Miftahul Hidayah, the students were grouped into three based on their abilities levels, i.e. high-ability, medium-ability, and low-ability students. From each group there are 8 high-ability students (27%), 16 medium-ability students (53%) and 6 low-ability students (20%). Two students were selected from each group to be interviewed. From the high-ability students are RI (S-1) and AZ (S-2), medium-ability students are SN (S-3) and MF (S-4), low-ability students are NI (S-5) and RF (S-6).

Table 1. Subject Ability Level

Code	Subject	Score	Level
S-1	RI	90	High
S-2	AZ	85	High
S-3	SN	70	Medium
S-4	MF	70	Medium
S-5	NI	55	Low
S-6	RF	50	Low

The test in the form of sharing task can be completed correctly. The analysis of the students' metacognition was focused on a single same question in the form of jumping task to reveal the difficulties which are experienced by the students. Besides, jumping task aims to challenge fast learner students to think critically so they do not feel bored during learning [19].

Based on the results of the students' answers and the interview with the subject based on the level of their ability, the students' difficulties can be identified as follows.

3.1 High-Ability Students

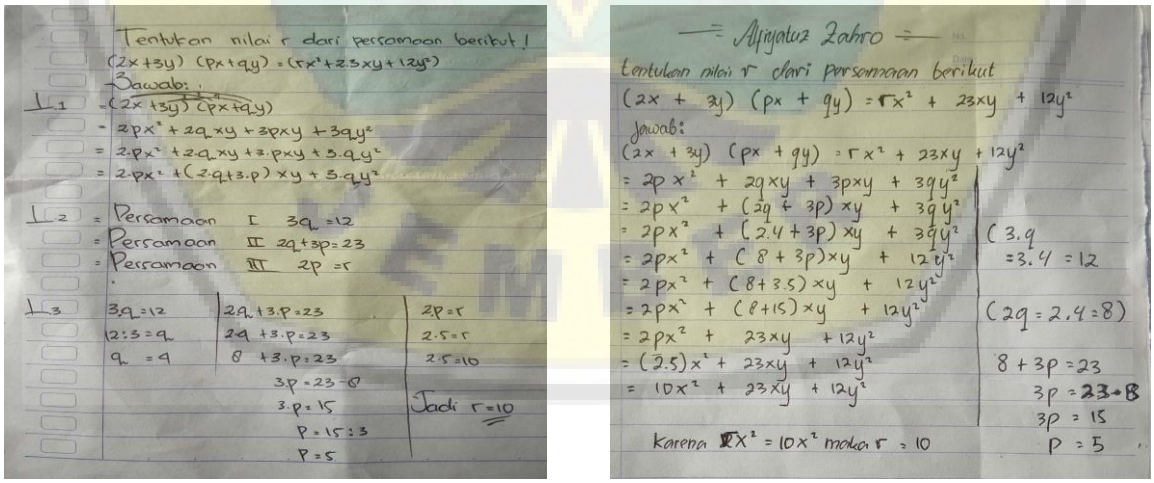

Figure 2. The Result of S-1 and S-2

The results showed that S-1 and S-2 understood the prerequisites material and operating concept of algebraic forms and find a problem-solving pattern which was presented and finished it correctly. S-1 was able to understand the problem well, identified the information in the problem, knew the purpose of the question and interpreted in a more operational form, knew the prerequisites material and when to use it, knowing the method to be used and the completion steps. S-2 little experienced difficulties in planning the completion steps. It was proved by not showing the sequence of the completion steps and stating *"I forget the steps to do it. Initially, I multiply the binomial times binomial as usual, after adding up the like term then it can be seen if the third term can find the score of q, then the binomial is*

found p, then later the score of r is also found". High-ability students did not experience difficulties in performing the operation of algebraic forms.

3.2 Medium-Ability Students

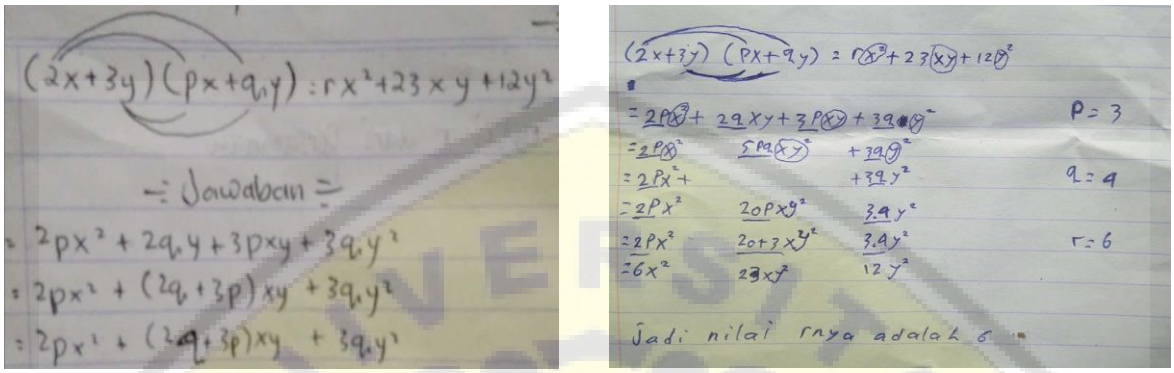

Figure 3. The Result of S-3 and S-4

The results showed that the S-3 and S-4 were similarly not quite so good at understanding the material prerequisites and operations of algebraic forms concepts. The S-3 was able to apply the concepts of algebraic operations, but he could not continue and change the equation that could help to find the value of q, p, and r. He experienced difficulty in determining the completion steps, had not found a completion pattern, and experienced difficulty to complete it correctly. Unlike S-4 who experienced difficulty to operate like terms, but he understood that there was an equation to help to find the value of p, q, and r. He did not feel that the concept used was incorrect. Medium-ability students sometimes experienced difficulties in doing the operations of algebraic forms.

3.3Low-Ability Students

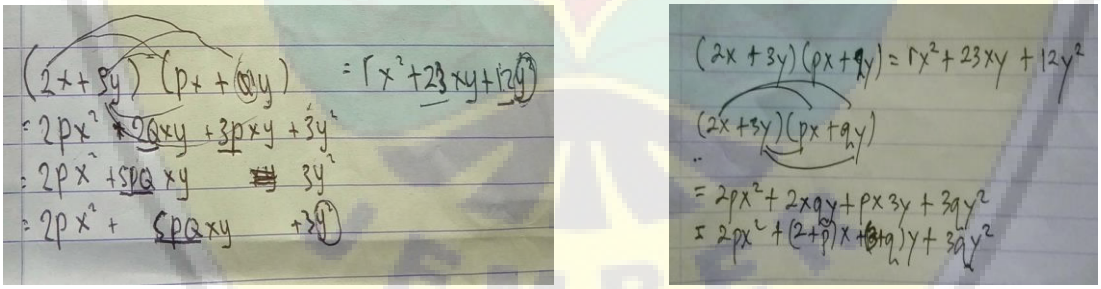

Figure 4. The Result of S-5 and S-6

The result showed that S-5 and S-6 did not understand the prerequisite material and the operation concept of algebraic forms. S-5 and S-6 could not continue and change the equation that could help to find out the value of q, p, and r. They got difficulties in determining the completion steps, finding the completion patterns and solving it correctly. Even the S-6 began to experience difficulty while operating a similar rate. This was evidenced through the results of their works and the results of interviews which stated that the questions were very difficult, complicated, and confusing. The low-ability students somehow had difficulties in doing the operation of algebraic forms.

Think aloud method was done after the interview by reworking the answer results and ask the subject to harden their voices from their thinking process while doing the task. This method was done by requesting the research subjects to solve the problems while telling their thinking process [20]. This was intended to find the students' thinking process which was *metacognitive control* consisting of the aspects of planning, monitoring and evaluating. This technique used a voice recorder so that the students' thinking processes could be analyzed deeply. The think aloud method is a special way to reveal a person's thinking process [20].

The voice recorder of the S-1 thinking process showed that the planning aspects as the contents of the recording *"... I multiply this one, the results can make an equation with the results of this"*. S-1 also showed that the monitoring aspects such as *"two q and three p are collected, this is xy xy"*. Afterward, the evaluation aspect was shown by hand movements that repointed from the initial process to the final result. While the voice recordings for S-6 did not show the aspects of planning, monitoring and evaluating properly. From the recording of *"two x times px, two px squared. Two times qy, two x qy. Three y times px, px three y. three y times qy, three q y squared, ..."*. This showed that S-6 only performed the operations in algebraic multiplication, they did not understand the errors, and did not evaluate the answers.

Based on the explanation above, there are differences in students' metacognitive knowledge skills. The ability of students' metacognitive knowledge was divided into two categories, they were students who had good and poor metacognition skills. Students' metacognitive skills and their influences on the students' metacognition control skills are outlined as follows:

1) Students who had good metacognition skills

In the aspect of declarative knowledge, being able to involve a prior knowledge as prerequisite material, skills and strategies were important for solving problems successfully. In the aspects of procedural knowledge, it was able to apply procedures like problem-solving strategies to utilize declarative knowledge in achieving the goals. Whereas in the aspect of conditional knowledge, it could determine when, where and why a declarative knowledge and procedural knowledge were used. Therefore, when applying the metacognitive control skills they were effective and efficient, such as being able to plan strategies and develop steps in solving the problems to achieve goals, monitoring while working on the problem and being able to evaluate the questions that had been done. In line with Herawaty's research, students could develop the ability to solve problems through self-reflection on planning, monitoring and evaluating the implementation of thinking processes [14].

2) Students who had poor metacognitive skills

In the aspect of declarative knowledge, not being able to involve prior knowledge as prerequisite material, skills and strategies are important for solving problems successfully. On aspects of procedural knowledge, it is unable to apply procedures as problem-solving strategies to utilize declarative knowledge in achieving goals. While in the aspect of conditional knowledge, it cannot determine when, where and why a declarative knowledge and procedural knowledge is used. Thus, they faced the difficulties when applying metacognitive control skills, such as they were not being able to plan strategies and compile steps to solve the problem to achieve the goals, unable to do the monitoring of the problem well, and unable to evaluate the questions that had been done. Rimbatmojo said that the difficulties of metacognitive are happened because of several factors, one of which on the characteristics of students' visual-spatial intelligence. Therefore, it is really important for mathematics educators to consider and pay more attention to students' visual-spatial intelligence and metacognition difficulty in designing better mathematics learning [15].

Based on the explanation above, the implementation of lesson study for learning community in learning used a collaborative and jumping task model could improve students' metacognition skills. Hobri declares that metacognition can be established when students work on problem-solving, work in small groups through collaboration in a community which cares for and learns with one another in the form of LSLC [16].

4. Conclusion

The results showed that students who had good metacognitive knowledge skills became effective and efficient when they were applying metacognitive control skills. Hence, the students who had poor metacognitive knowledge skills, they experienced difficulties when they were applying metacognitive control skills.

The contribution of jumping tasks based on lesson study for learning community is very helpful in enhancing students' metacognition abilities and skills to individually, in groups and classically.

Because giving a jumping task is able to create learning activities among students such as dialogue, interaction and effective collaboration. In addition, through jumping tasks, students are educated to think independently and grow up with each other.

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