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Analysis of metacognitive characteristics in group discussion on grade 5 fraction materials

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ABSTRACT

Math problems require students to think critically in solving a problem. Metacognition leads to the ability to think critically and think at a higher level cognitive process in learning. This study aims to describe the characteristics of metacognition in group discussions on fraction material for grade 5 elementary school students. This type of research uses qualitative descriptive research. The data collection methods used in this research are observation, interview and documentation. The characteristics of students' metacognition can be obtained through observation when students discuss working on problems. Metacognitive activities of 5th grade elementary school students are classified into 3 namely awareness, regulation and evaluation. Students' metacognitive awareness is able to understand the problem and students are able to know what the next thing will be done after understanding the problem. Regulation students are able to choose the strategy that will be used to solve the problem and students are able to apply the chosen strategy to solve the problem. Evaluation students are able to check the answers that are done correctly and are able to ensure that the answers are correct. During group discussions, students are divided into 3 roles, namely students as experts, facilitators and beginners. During group discussion activities to solve problems, not all metacognitive activities appear in each student. Facilitators can influence beginners to be active in the discussion and expert students can help group mates to rethink what they have done before.

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Introduction

Critical thinking skills are an important component in dealing with 21st century life so it needs to be developed in the curriculum in elementary schools. Critical thinking is an inseparable part of education, and critical thinking is a very important cognitive ability (Sa'dijah et al., 2023; Sholihah et al., 2019). Therefore, the ability to think critically in learning mathematics is very important for students (Subanji & Fitri Amalia, 2019). Through critical thinking, students can analyze problems to conclude the results of the problem (Muksar et al., 2022). The problem that often occurs when students are faced with math problems is not thinking about how they are able or unable to solve them. Thinking for themselves is related to students' awareness of their ability to develop various ways that might be taken in solving problems (Kopparla et al., 2019). In working on problems individually, students rarely or even do not recheck answers. Learners only work according to predetermined procedures therefore it is expected that in learning mathematics students can learn in discussions to develop

students' abilities by thinking back to what has been done together in different ways (Sa'dijah et al., 2021). Learning mathematics using problem solving is done to solve problems on problems related to numbers and symbols (Faridah, 2014). Mathematical problem solving is a process in terms of understanding the problem to plan the solution and carry it out through the awareness of the audience involved (Sylvia et al., 2019).

Students' awareness in solving problems is very important because through this awareness students can know the correct solution process, and students can evaluate the location of their solution errors, namely between conceptual or procedural errors (Sa'dijah et al., 2021). This awareness, known as metacognition which means as a complex thinking ability needed by someone in solving mathematical problems, so problem solving requires the attention of educators to help optimize students' problem solving skills (Huda et al., 2021). Mathematical problem solving skills need to be taught to students so that students can optimize their thinking skills (Ulandari et al., 2019). Thinking skills cannot be separated from the ability to manage knowledge and information resources that students already have. This thinking skill is called metacognition (Hancock & Karakok, 2020). The concept of metacognition is the idea of thinking about one's own thoughts. It includes awareness of what one knows (metacognitive knowledge), what one can do (metacognitive skills) and what one knows about one's own cognitive abilities (metacognitive experience) (Lei et al., 2020). Metacognition is a person's awareness or knowledge of the process and results of his thinking (cognition) and his ability to control and evaluate the cognitive process (Lestari et al., 2019). Metacognition is the ability to reflect on what one knows and does and what one does not know and does not do". Which can be simplified as "thinking about how to think" or "cognition about how to cognize", metacognition itself is a science that is more specific and consists of several cognitions, it plays an important role in developing stronger learning skills in a learning process. Metacognitive skills refer to activities that aim for practice (Baten & Desoete, 2019). This is also due to the development of metacognitive awareness triggered by the development of cognitive ability skills themselves (Branigan & Donaldson, 2020).

In this era, teachers are not only required to deliver learning materials but also empower various 21st century competencies (Husain & Kaharu, 2020). Various thinking skills that are the foundation of 21st century skills must be known, understood by teachers and how to empower them must be known. There are several thinking skills, metacognitive skills being an important skill that also supports and relates to other skills. Metacognition plays one of the critical roles (very important) for successful learning (Smith & Mancy, 2018). Metacognition leads to high order thinking skills including active control of cognitive processes in learning (Faradiba et al., 2019). The importance of metacognition in learning aims to make students aware of their abilities and deliberately organize and monitor their knowledge during learning and problem solving (Sumitro et al., 2019). Therefore, teachers as the main component in the learning process are also expected to have good metacognitive skills. The better the teacher's metacognitive skills, the more optimal the empowerment of these competencies. With this, prospective teachers must have good metacognitive skills. Because it is impossible for someone to empower metacognitive skills well if he himself does not master these skills (Dwi et al., 2021).

When metacognitive knowledge is possessed by students, it will result in a meaningful learning process for students, not just stopping at remembering a subject matter. This is related to the achievement of educational goals. Educational objectives that foster the ability to remember are quite easy to formulate, but objectives that develop the ability to transfer are more difficult to formulate, teach and assess. Students are expected to reuse the same learning strategies in different situations and problems (zuriati suci et al., 2021). Metacognition focuses students' learning activities on the area of mathematical problem solving (Mokos & Kafoussi, 2013). Metacognition strategy is one of the factors that can affect students' success or failure in solving math problems (Aminah et al., 2018). Metacognition strategies are divided into 3 types, namely awareness, evaluation, and regulation. Awareness in metacognition relates to individual awareness of its existence in the problem-solving process and awareness of specific knowledge, as well as strategies for problem solving; evaluation metacognition refers to the assessment of the thinking process, thinking capacity and limitations of ability in certain situations; while regalution in metacognition refers to the individual's specific knowledge and skills to optimize the thinking process.

Metacognition has characteristics based on the audience or students who experience it. The characteristics of students' metacognition can be known by conducting tests to students by giving assignments with difficult questions or HOTS questions. HOTS category questions require students to have an understanding of information, reasoning not just remembering information, and higher order thinking skills. In addition, HOTS learning can encourage the development of students' thinking. HOTS learning can help teachers to identify the needs of students, especially gifted students, in solving HOTS problems (Murwanto et al., 2022). Therefore, information or basic questions (stimulus) are needed to make it easier for students to answer questions and students to show understanding of ideas and use the information.When students are faced with a problem related to mathematics, students can use thinking skills to explore, retrieve, analyze and evaluate information in solving

the problems they face (Aryani et al., 2019). HOTS questions that students work on can use several methods. Students usually solve HOTS problems using group discussion, question and answer, and problem solving. The discussion method is an activity carried out by students to regularly exchange information, opinions, and elements of experience. The purpose of the exchange is to obtain a clearer and more thorough understanding of something that is the subject of discussion, as well as to prepare and finalize a joint decision. Therefore, discussion is different from the debate method, which is considered to tend to argue.

Discussion is also different from the lecture method, which does not only involve teacher direction, but in discussions students try to explore various things related to the theme or material being studied (Vita Susana dan Suyato MPd et al., 2017a). Student metacognition is divided into 3, namely students with low achievement, students with moderate achievement and students with high achievement (Smith & Mancy, 2018). First, it can be said that students with low achievement because these students have not shown any metacognitive activities, such as planning, monitoring or monitoring, and assessment activities. Students can carry out planning activities at the stages of solving Polya model math problems (Brijlall, 2015; Hidayat et al., 2019). Second, students with moderate achievement can already involve their metacognition activities at each stage of the math problem solving process, but not yet optimally. Students are still not good at assessing or reflecting. Finally, high-achieving students can involve their metacognition activities at each stage of the math problem solving process well, namely through planning, monitoring, and assessment activities.

This research has been conducted with students' metacognition activities in group discussions to solve problems in Senior High Schools, other studies have been conducted in Elementary Schools but not conducted with the discussion method. As for other studies conducted in elementary schools in group discussions have not linked to metacognition activities. Based on the description above, the author conducted research on shifting students' metacognition in solving math problems through group discussions to support students' thinking to be more logical and critical for future education. The renewal of this research is that if the previous research examined students' metacognition on independent assignments, this research examines students' metacognition during group discussions, the role of students in group discussions, and also student activity in terms of the role of students during group discussions. The purpose of this study was to describe the metacognitive characteristics in group discussions on fraction material for grade 5 elementary school students.

Method

This research uses descriptive qualitative research, where the researcher is the main role in analyzing the object to be studied. Qualitative research seeks to discover and describe narratively the activities carried out and the impact of the actions taken on their lives (Nina Adlini et al., 2022). The participants in this study were grade 5 elementary school students totaling 10 students consisting of 7 male students and 3 female students. Interview activities were carried out after students conducted the discussion process, this question was to find out the metacognitive abilities of each grouping. One example of a question in this interview is "what do you think after finding the answer, why do you check/re-work on the problem that has been done?". The subject used in this study is mathematics. And the research instruments used in this research are interviews, observation, and documentation. The first is observation activities carried out on grade 5 elementary school students. Second, the source of the interview was 5th grade students. Data analysis used by researchers is data reduction, data presentation, and conclusion drawing. To check the validity of the data used in this study using data triangulation.

The data instrument used in this study is in the form of group discussion questions or problems that must be solved, then the researcher makes gradual observations of the implementation of group discussions. The research was continued with an interview to find out the students' metacognitive process. The following things were measured in the observation, including: (1) Metacognitive Awareness. Metacognitive awareness is measured using the ability of students to rethink the problems given and can solve problems using the development of their abilities. (2) Metacognitive evaluation. The second stage in the form of metacognitive evaluation is used where learners have to rethink answers that they think are not correct. Therefore, learners must correct what they have done to get the right results. Metacognitive regulation. The last stage is a regulation where students can rethink the strategy planning that has been discussed where they have to choose the right strategy in order to solve the problem correctly (Sa'dijah et al., 2021).

The observation activities are organized using the appropriate scores. The observation score is rated from vulnerable 1-4 with 3 aspects of learning. Of course, this observation is supported by the interview and questionnaire aspects that must be answered by students. There are 8 interview questions that students answer to measure metacognitive shifts and development. These questions can support the observations made. Meanwhile, the questionnaire uses 10 statements that can be filled in by students as a form of metacognitive

development. In this study, data analysis was carried out in 3 ways, namely data reduction, data presentation and conclusion drawing. In this data reduction stage, researchers collect existing data which is then reduced by sorting and selecting the data needed from the data obtained during the research.

Results and Discussions

Based on the analysis of the results of observations and interviews, students have difficulty solving problems on problems related to numbers and symbols. Therefore, metacognitive activities were carried out for students in grade 5 in group discussions. The following is data on students' metacognitive activities in grade 5:

Metacognitive activity data of 5th grade students in group 1 and 2

On Sunday the mother will make 2 cakes, namely 1 large cake and 1 small cake whose basic ingredients are wheat flour. To make 1 big cake the mother needs $3\frac{3}{7}$ kg of flour. While to make 1 small cake the mother needs $1\frac{3}{14}$ kg of flour. How much flour should the mother buy

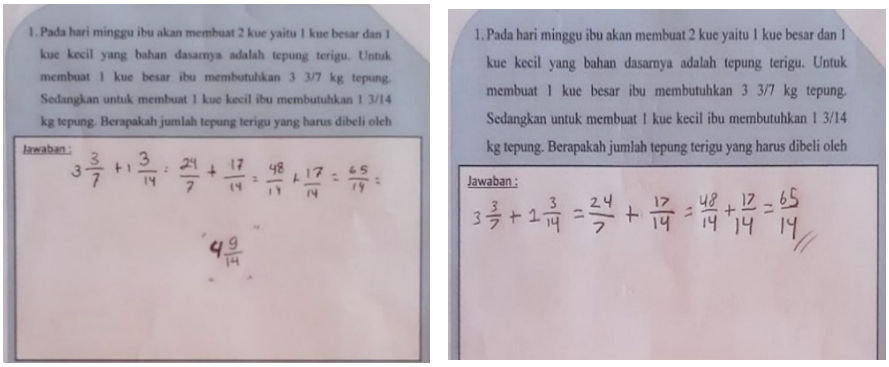

Figure 1. Answer to Problem No.1

From the student's answer in the awareness component (metacognitive awareness) students are able to show awareness of the things needed to solve the problem, this can be seen from students being able to understand and solve, and can see subjective and concrete conclusions about story problem number 1, namely the problem of adding mixed fractions which is translated into a story problem (Triwahyuningtyas & Sesanti, 2023). In the evaluation component (metacognitive evaluation) shows that students write the formula used, namely the formula for adding mixed fractions. And students have also written the correct answer from the answer. Furthermore, in the regulation component (metacognitive regulation) students are able to show that students can choose and determine the right strategy design that will be used to solve the problem so that students can solve the problem with the correct answer. The regulation component is used to control their cognitive activities and ensure their cognitive goals are achieved. (Faradiba et al., 2019).

When solving question number 1 out of 5 students, there was 1 student (facilitator) who actively organized his friends to read the question and ask how to solve the question. 2 students (experts) who really dominated the discussion decided by directly adding up the flour needed. 2 students (beginners) follow and write what the expert does, but occasionally ask the expert. The difference in the answers of groups 1 and 2 is that the results of group 1's answers were converted to mixed fractions, while those of group 2 were not. Because the cat sand at doni's house ran out, today doni will buy 5.812 kg of cat sand. but on the way home doni did not realize that the plastic bag had a hole so that the cat sand he had bought fell as much as 1.631 kg. how much cat sand does Doni have left?

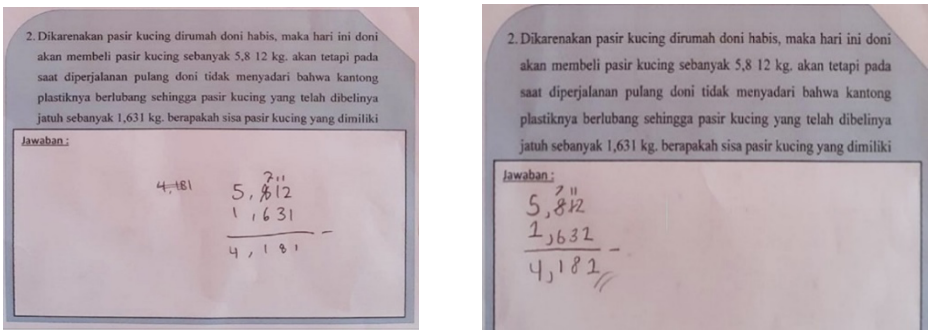

Figure 2. Answer to Question No.2

From the student's answer in the awareness component (metacognitive awareness) students are able to show awareness of the things needed to solve the problem, this can be seen from students being able to understand and solve story problem number 2, namely the problem of subtraction of decimal fractions which is translated into a story problem about doni buying cat sand and some of the sand bought by doni falls because the plastic bag has a hole and what is sought is the rest of the cat sand that doni has (Triwahyuningtyas & Sesanti, 2023). In the evaluation component (metacognitive evaluation), it shows that students have used the right formula, namely the formula for subtracting decimal fractions. And students have also written the correct answer to the problem. From this statement, it means that students have been able to bring fulfill the evaluation component (metacognitive evaluation). Furthermore, in the regulation component (metacognitive regulation) students are able to show that students can choose and determine the right strategy design that will be used to solve the problem so that students can solve the problem with the correct answer using the steps of working on the problem they have chosen (Faradiba et al., 2019).

When solving question number 2, out of 5 students, 1 student read the question aloud, then 1 student (facilitator) asked how to do question number 2. Next, 2 students (experts) worked in descending order according to place value. 1 student (beginner) only follows what the expert does. There is a difference in the answers of groups 1 and 2 where the results of group 1's answers are appropriate while group 2 incorrectly wrote 1.631 to 1.632 so the subtraction results are not appropriate.

During a family vacation, mom will bring 2 pieces of chocolate pudding. To make 1 chocolate pudding, mom needs 0,25 packets of pudding powder and 2,75 cups of water. How much pudding powder and water will mom need to make 2 puddings?

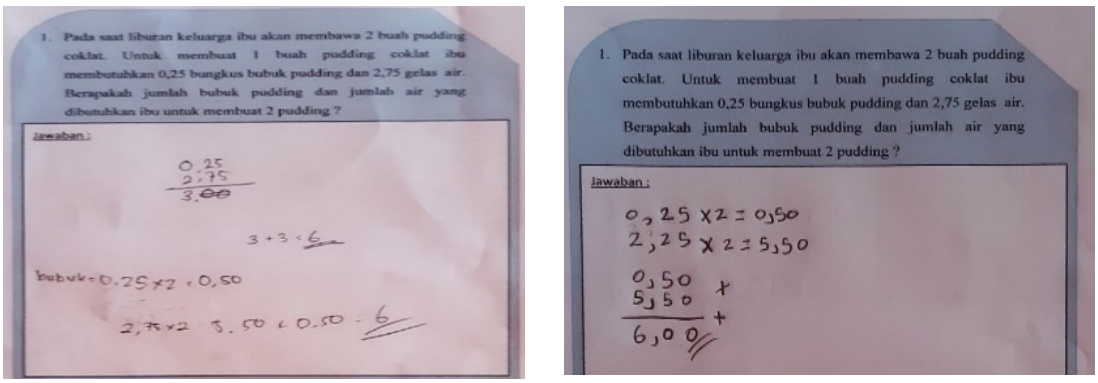

Figure 3. Group 1's answer to Question No.3

In solving question number 3, group 1 worked in 2 ways. First add them together and multiply by two. Second, each of them is multiplied by two then added together. Group 2 works in one way. In solving question number 3, expert students work on each one and compare it with the others. The student facilitator writes answers and organizes the course of the discussion. For beginner students, ask about how to do these questions.

From the student's answer in the awareness component (metacognitive awareness) students are able to show awareness of the things needed to solve the problem, this can be seen from the students can understand and solve story problem number 1, namely the problem of multiplying decimal fractions which is translated into a story problem about a mother who will make 2 puddings and requires 0.25 packets of pudding powder and 2,75 glasses of water for 1 pudding, while what is asked is the amount of each ingredient used to make 2 puddings. However, students do not write what is known, what is asked from the question. From this statement, it means that students have not fully the awareness component (metacognitive awareness) (Triwahyuningtyas & Sesanti, 2023). In the evaluation component (metacognitive evaluation), it shows that students use the right formula, namely the formula for multiplying decimal fractions. However, students do not write what is known and what is asked. From this statement, it means that students have not fulfilled the evaluation component (metacognitive evaluation). Furthermore, in the regulation component (metacognitive regulation), students are able to show that students can choose and determine the strategy design that will be used to solve the problem so that students can solve the problem with the correct answer using the steps of working on the problem they have chosen. However, students are still incomplete in writing the answers to the problems they do, for example students do not write what is known, what is asked from the problem (Faradiba et al., 2019).

Judging from the research above, it can be found that the three metacognitive activities of students during group discussions. This is in accordance with previous research, namely in the research of (Magiera & Zawojewski, 2011) which in her research also contained 3 metacognitive activities consisting of metacognitive

awareness, metacognitive regulation and metacognitive evaluation. However, not all students can bring up metacognitive activities during group discussions on fraction material.

Metacognitive awareness

Based on what the researchers saw and obtained during observations, questionnaires and interviews, metacognitive activities on the metacognitive awareness component, not all students were able to bring up this component in group discussion activities on fraction material conducted by students. Students can be said to fulfill the awareness component if students are able to understand the problem to be solved, are able to understand what further steps will be taken to solve the problem, and are able to get information on the problems obtained. This is in accordance with research (Setyaningrum et al., 2020) Metakognisi awareness It is a person's awareness of his or her place in the problem-solving process and specific knowledge about the problem at hand. It also includes knowledge of strategies to solve the problem, what needs to be done, what has been done, and what is possible in the process of solving the problem (Sa'dijah et al., 2021).

Metacognitive regulation

The second metacognitive component is metacognitive regulation. Seen during observation, each group has shown the existence of metacognitive regulation activities. The indicators of metacognitive regulation are Planning strategies; Work steps in solving problems; Thinking about what to do next; Choosing a problem-solving strategy to use (Magiera & Zawojewski, 2011). In accordance with the indicators of metacognitive regulation above, the regulatory activities experienced by students are that students can choose the right strategy that will be used to solve problems, students can apply the strategies they have chosen to solve existing problems and students can also choose the right strategy again to correct the answer if there is an incorrect answer. Student activity in choosing the right strategy again is in accordance with research (zuriati suci et al., 2021) . Students are expected to reuse the same learning strategy in different situations and problems. The ideas obtained by students come from students themselves during group discussions. The selection of the right strategy is obtained by students from group discussions with their groupmates. Although during group discussions there were differences of opinion, in the end students could determine the right strategy to choose.

Metacognitive evaluation

The third metacognitive component is metacognitive evaluation, where all groups can bring up metacognitive evaluation activities even though not all students in their groups can bring up the metacognitive evaluation component. Students can be said to fulfill the metacognitive evaluation component if students meet the indicators of metacognitive evaluation. Assessment of the limitations of one's own or others' thinking processes; Effectiveness of the chosen strategy; Assessment of the results obtained; Assessment of the difficulties faced; Assessment of the development of one's own abilities and understanding (Magiera & Zawojewski, 2011). From the observation data, it can be seen that during group discussions students can check again to ensure that the answers they have done are correct, students can check correctly, and students are able to ensure that the problem solving and answers are correct even though in the end there is still one answer that is not correct due to an error in calculating.

In checking the answers, students use various ways to get the correct results such as recalculating the answers, rechecking the formulas used and others. This is done in accordance with (Vita Susana dan Suyato MPd et al., 2017b). Such is the complexity of the problem that it cannot be impossible to solve with just one answer, but must use all the knowledge available to find the best solution all of our knowledge to find the best solution. There are 3 types of roles that arise when students discuss in groups, namely students as experts, students as facilitators and also students as beginners.

After analyzing the data, the fact is that grade 5 elementary school students who are divided into 2 groups have met the indicators of metacognition. However, during group discussions, students are divided into 3 roles, namely there are students who play the role of experts, facilitators and beginners. The first category is students as experts. At the stage of understanding the problem, students as experts are able to understand the problem well, students are able to know what is known and what is asked in the problem and students who have a high metacognitive level are able to ensure that the information obtained is correct. So that students as experts have been able to think metacognitively at the stage of understanding the problem. At the stage of making and carrying out plans, students as experts are able to develop the strategies they choose to solve the problems given (DeJarnette & González, 2015). Students as experts are able to choose the right and correct strategy which will then be applied to the problem to be solved. As an expert is able to apply the strategy he has chosen correctly so as to get the correct final result. So that students as experts have been able to think metacognitively at the stage of making and carrying out plans. The stage of reviewing, students as experts are able to find and develop the right plan that will be used to test the solution, students as experts are able to carry out the solution test correctly (Williams & Svensson, 2020a). In addition, students as experts can also ensure that the problem solving

solutions obtained are correct and have been able to ensure that the answers obtained are correct. So that students as experts have been able to think metacognitively at the review stage.

Table 1. Student metacognitive activities are based on student positioning during group discussions

Positioning	Metacognitive Activity
Expert	Awareness
	After reading the problem students rethink the problem solving clues
	After reading the problem, students rethink the solution that will be done
	Evaluation
	Rethinking previously thought-out strategies
	Thinking about the error or correctness of the problem-solving strategy
	Regulasi
	Writing down the steps in a coherent manner
	Write down the result of solving the problem
	Write down the conclusion
Fasilitator	Awareness
	After reading the problem students rethink the problem solving clues
	After reading the problem, students think about the problem solving that will be done
	Evaluation
	Rethinking previously thought-out strategies
	Confirming previously thought strategy to a friend
	Regulasi
	Asked groupmates the next step
	Give directions on the steps of working on the problem to friends to write on the answer sheet
Pemula	Awareness
	Listening and listening to expert explanations
	Evaluation
	Ask about what you don't know
	Understand mistakes and not make them again in the future

The second category is students as facilitators, at the stage of understanding the problem students as facilitators are able to understand the problems given. Students are able to know what is known and what is asked in the problem and students as facilitators are able to ensure that the information obtained is correct. Thus, students with moderate ability have been able to think metacognitively at the stage of understanding the problem. At the stage of making and carrying out plans, students as facilitators are able to choose the strategy they choose to solve the problems given (Dewi et al., 2019). Students as facilitators are able to choose strategies that will then be applied to the problem to be solved. Students as facilitators are able to apply the strategies they have chosen even though they are not optimal. Students as facilitators are able to coordinate their friends to participate in group discussions to work on problems. Thus, students with moderate ability have been able to think metacognitively at the stage of making and carrying out plans even though it is not optimal. At the review stage, students as facilitators are able to find a plan that will be used to test the solution. students as facilitators are able to carry out the solution test correctly (Wester, 2020). However, students as facilitators have not been able to ensure that the problem solving solution obtained is correct and students as facilitators have not been able to ensure that the answers obtained are correct. So that students as facilitators have been able to think metacognitively at the reexamination stage even though they have not been maximized.

The third category is students as beginners. At the stage of understanding the problem, students as beginners have not been able to understand the problem given, students have not been able to know what is known and what is asked in the problem.(Chen & Liu, 2020) So that students as beginners have not been able to think metacognitively at the stage of understanding the problem. The stage of making and carrying out plans, students as beginners have not been able to choose the right strategy to solve the problems given(Williams & Svensson, 2020b). Students as beginners have not been able to apply the strategy that has been chosen to the problem to be done. So that students as beginners have not been able to think metacognitively at the stage of making and carrying out plans. At the review stage, novice students have not been able to find a plan that will be used to test the solution. as novices have not been able to carry out the solution test correctly. And students as beginners have not been able to ensure that the answers obtained are correct. So that students as beginners have not been able to think metacognitively at the stage of reviewing.

Conclusions

Metacognitive awareness of grade 5 students in elementary school which is divided into 2 groups is classified into 3, namely metacognitive awareness, metacognitive regulation and metacognitive evaluation. At the metacognitive awareness stage students are able to understand the problem and students are able to know what the next thing will be done after understanding the problem. At the regulation stage, students are able to choose the strategy that will be used to solve the problem and students are able to apply the chosen strategy to solve the problem. And finally at the evaluation stage, students are able to check the answers they have done correctly and students are able to ensure that the answers they have done are correct and correct. During group discussions, each group has 3 roles, namely there are students as experts, there are students as facilitators and there are students as beginners. During group discussion activities to solve problems, not all metacognitive activities appear in each student, there are some students who bring up all metacognitive activities and there are also students who do not bring up their metacognitive activities either one or all of the metacognitive activities.

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