

Improve Critical Thinking Ability and Mathematical Representation of Junior High School Students Through Soft-skill Based Metacognitive Approaches

Luluk Faridah, Aulatun Nasikhah

Pendidikan Matematika FKIP UNISDA Lamongan, Indonesia

lulukfaridah47@yahoo.co.id, aulatunnasikhah17@gmail.com

Abstract—The purpose of this research is to find out differences in critical thinking skills and mathematical representations between students taught with a soft skills-based metacognitive approach with students taught with conventional approaches. The research method used is true experimental design with pretest-posttest design of random subject control groups. The results of the study show that there are differences in critical thinking abilities between the experimental class and the control class with value the independent t-test test of the posttest scores of students with the same assumption of variance obtained by the value of sig (2-tailed) $0.048 > 0.05$. And there are differences mathematical representation between the experimental class and the control class with value the Test of independent t-test shows the posttest value of students with the same assumption of variance obtained sig (2-tailed) values of $0.019 > 0.05$. So that based on the research that has been done, it is expected that educators can apply a soft skills-based metacognitive approach to improve students' critical thinking skills and mathematical representations.

Keywords— *Critical Thinking, Mathematical Representation, Metacognitive, Soft Skill.*

I. INTRODUCTION

The low ability to think critically results in students being unable to master and solve problems. That to be able to think critically, students must be able to achieve the indicators of critical thinking skills [5]. One of the indicator of critical thinking ability, according to Ennis is to set strategies and tactics to solve problems [1]. In managing strategies and tactics, of course, it requires mathematical representation. Beside, critical thinking students also experience difficulties in mathematical representation abilities.

In relation with critical thinking skills, the core skills in critical thinking are: interpretation, analysis, evaluation, inference, explanation and self-regulation [3]. When associated with metacognition that plays an important role in designing, monitoring, and evaluating a person's cognitive processes in learning and thinking, then these skills are related to metacognition.

To develop students thinking skills, it is absolutely necessary to have mathematics learning which involves more students actively in the learning process itself. This can be

realized through an alternative form of learning designed in such a way as to reflect active student involvement that instills metacognition awareness. By developing awareness of metacognition, students are trained to always design the best strategy in choosing, remembering, recognizing, organizing the information they face, and solving problems. Through the development of metacognition awareness, students are expected to be accustomed to always monitoring, controlling and evaluating what they have done.

The use of soft skills aspects in students in the form of personal and interpersonal behaviors that develop and maximize one's performance related to self-confidence, flexibility, honesty and self-integrity are factors of success in learning and applying them in their lives [4].

Metacognitive approach based on soft skills is an approach used to train students to explain their knowledge to through the instructions given so that students can manage and control every thought process they do..

II. LITERATURE REVIEW

A. Critical Thinking

The ability to think critically is a high-level thinking ability that is focused on the breakdown of what must be believed or done to make decisions in resolving problems by giving simple explanations (analyzing arguments and asking and answering challenging questions), building basic skills (considering the truth of the source and observing and consider the results of observations), make inferences (make and consider the results of decisions), make further explanations, and set strategies and tactics [1, 2].

B. Mathematical Representation

The ability of mathematical representation is the ability to express problem situations in a symbolic form in the form of mathematical questions/mathematical and numerical notation [6]. By presenting the data/information from a representation to the diagram representation, graph/table, making a mathematical model of the other representation given, and making a representation to the diagram

representation, graph/table to clarify the problem and facilitate its completion.

C. Metacognitive Approach

A Metacognitive Approach is an approach that instills awareness of how to design, monitor and evaluate (control what is known, what is needed in doing and how to do it) to be developed into actions to solve mathematical problems that are carried out in three stages, as follows: (1) initial discussion, (2) independence, (3) reflection and making conclusions.

D. Soft Skills

Soft skills are a set of skills students have in managing themselves both in interacting with friends and teachers in the learning process which includes: religious, self-esteem, self-reliance, responsibility, honesty, mutual respect, curiosity, hard work, courtesy, caring, and work together.

E. Metacognitive Approach Based on Soft Skills

Metacognitive approaches based on soft skills are a learning approach used in mathematics learning that has metacognitive components accompanied by the application of student soft skills. Learning is done through five stages, as follows: (1) initial discussion, (2) independence, (3) group discussion, (4) group presentation, (5) reflection and making conclusions

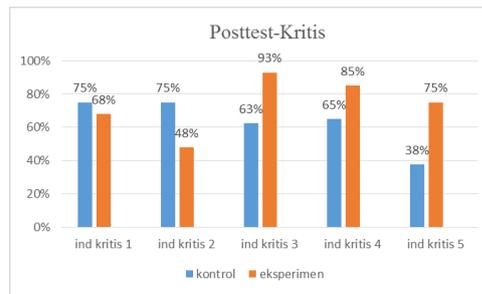
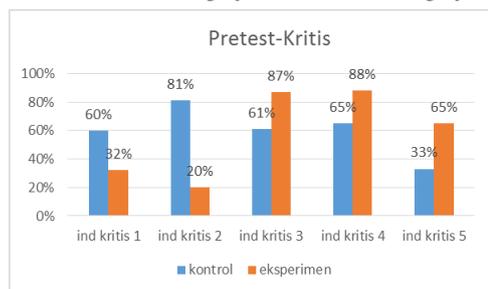
III. METHOD

This is quantitative research that aims to determine students critical thinking abilities and mathematical representations that achieved soft skills based metacognitive approach in mathematics learning. This research is classified into the true quantitative research experimental design with pretest-posttest design of random subject, and control groups.

The subjects in this research were seventh grade students of Simanjaya Middle School 207/2018 school year, Class VII Regular 1, consisting of 22 students as a control class and Regular VII 2 consisting of 23 students as an experimental class, (classes that received learning with a soft skills based metacognitive approach in mathematic learning.

IV. RESULTS AND DISCUSSION

A. The Increasing of Critical Thinking of Each Indicator



Explanation:

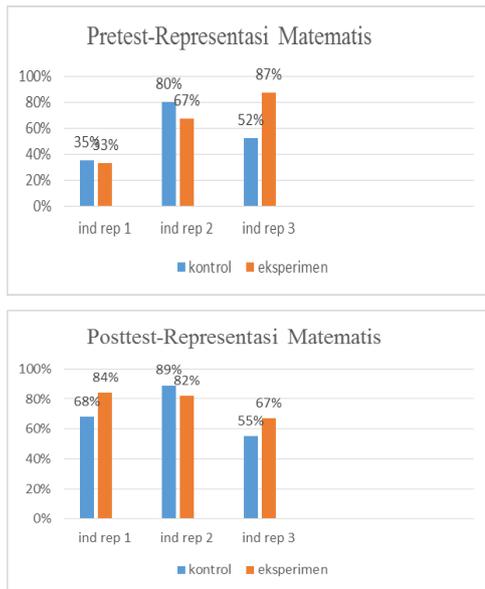
Indicator of Critical Thinking

1. Explain and give meaning to data/ information.
2. Explain/express thoughts based on evidence.
3. Identify and obtain the elements needed to make conclusions.
4. Identify the relationship of information obtained to solve the problem.
5. Determine the conclusion of the solution to the problems obtained.

There is a difference between students critical thinking skills who are taught with a soft skills-based metacognitive approach and are taught with conventional learning. This can be seen from the results of the posttest of the experimental class and control class, where the achievement of the first indicator the experimental class data/information reaches 67.5% while the control class is 75%, the control class achieves higher achievement than the experimental class. As well the second indicator based on the control class reaches 75% while the experimental class is only 47.5%. However, for the third indicator the experimental class higher and achieves a significant difference of 82.5% for the experimental class, while the control class is only 62.5%. Likewise for the achievement of critical thinking fourth indicator of control class students reaching 65% while the experimental class was higher at 85%. For the achievement of critical thinking fifth indicator achievement obtained by the experimental class by 75% and the control class 37.5%. The difference in critical thinking skills can also be seen from the results of independent t-test of the posttest scores of students with the assumption of the same variance (Equal variance assumed) obtained by the value of sig (2-tailed) $0.048 < 0.05$.

As for the improvement of critical thinking skills that are calculated using the N-Gain test on the criteria of high improvement is 9% while in the control class is 0%, the criteria for increasing the experimental class is 52% more than the control class which is only 32%, while the criteria for low increase in control class is higher at 59% while the experimental class is only 35%. It can be seen that in this analysis there are 4% of data that is invalid in the experimental class and 9% in the control class. Based on the results of the question and answer conducted with the research subjects, it turns out that when the final test, is held the experimental class subjects did not prepare themselves to face the final test, so the value decreased. While subjects from the control class have difficulty to understanding posttest questions. So this shows that the increase in the experimental class is the criteria of medium increase stage with a percentage of 52%. While the control class experienced an increase in critical thinking skills at a low stage with a percentage of 59%.

B. The Increasing of Mathematical Representation of Each Indicator



Explanation:

Indicator of Mathematical Representation

1. Using visual representations in the form of diagrams, graphs, tables and images.
2. Make equations or mathematical models from other representations given.
3. Compile stories or write interpretations that correspond to a representation presented.

There is a difference between students mathematical representation abilities taught with a soft skills-based metacognitive approach and students mathematical representation abilities taught by conventional learning. This can be seen from the results of the posttest of the experimental class and the control class, where the achievement of the first indicator the experimental class reached 84% while the control class was only 65%. The second indicator the control class was 89% while the experimental class was 82%. For third indicator a higher experimental class that is 67% while the control class is 55%. The percentage of each indicator between the experimental class and the control class for the first and second indicator has a significant difference so that there is a significant difference in the indicator achievement. It was seen that the experimental class had a higher increase compared to the control class. Differences in critical thinking skills can also be seen from the results of independent t-test of the posttest scores of students with the assumption of equal variance (Equal variance assumed) obtained by sig (2-tailed) value $0.019 < 0.05$ which means that there is a significant difference between the control and experimental classes.

The improvement of mathematical representation ability in the experimental and control class based on the data of the difference between N-Gain experimental class and control class shows that the increase in the mathematical representation ability of the experimental class students on the high criteria is 9% while in the control class is 0%, the

experimental improvement criteria is the class. 74% more than the control class which was only 68%. While the criteria for low increase in control class is higher at 32% and the experimental class is only 17%. This shows that the increase in the experimental class is in the criteria for medium increase stage. While the control class also experienced an increase in critical thinking skills in the moderate stage. Although both classes have increased in the medium level criteria but the experimental class has a higher presentation value.

C. Student Soft-Skill Ability

The ability of students' soft skills in this study is obtained from the results of questionnaires that have been given to control class students and experimental class students, the calculation results show that the highest value obtained by the experimental class is 122 while the control class is 98. For the minimum value of the experimental class is 81 and the control class is 79, so the average value for the control class is 102.04 while the control class is only 85.36. From the value of the soft skills questionnaire, it is known that the ability of students in the experimental class soft skills is higher than the control class students.

TABLE I THE RESULT OF STATISTICS

Statistics	Class	
	experimental	control
The Number of Students	23	22
Maximum Value (X_{max})	122	98
Minimum Value (X_{min})	81	79
Average	102,04	85,36
Median (Me)	104,00	84,00
Modus (Mo)	106,00	84,00
Varians	155,953	36,147
Standard Deviation	12,488	6,012

V. CONCLUSION

Based on the results of the study and its discussion, it can be concluded that there are differences in critical thinking skills and mathematical representations between students taught with a soft skills-based metacognitive approach with students taught with conventional approaches. Increased critical thinking skills and mathematical representations occur at a moderate stage.

After conducting research, the researcher suggested several things, including the use of mathematics learning with a soft skills-based metacognitive approach should be chosen by the teacher as one of the learning approaches that can be applied to improve students critical thinking skills and mathematical representations, as well as for further research. regarding the application of a metacognitive approach based on soft skills to other aspects of mathematical ability.

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