STUDY OF LITERATURE THE LEVEL OF CRITICAL THINKING ABILITY OF STUDENTS RELATED TO MATHEMATICS MATERIALS

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Abstract: The purpose of this paper is to discuss the level of students' critical thinking skills in solving problems related to the topic or subject matter of Mathematics. To achieve this goal, the method used is literature study by describing the ability to think critically based on several experts and describe the leveling of critical thinking based on the study of supporting references. In everyday life, one cannot escape thinking. One of the thinking activities needed in life is critical thinking. The development of critical thinking skills can be done through school, which is one of them in the Mathematics learning process. Giving problem solving can help students develop critical thinking skills. But in the development of critical thinking processes, even though students receive the same material and the learning process, it does not rule out the possibility that there are differences in the ability to think critically in each student. Differences in the ability to think critically in students can be revealed by making groups based on certain criteria so that the level of critical thinking skills of students from highest to lowest can be seen.

Keywords: leveling, critical thinking, mathematics

1. Introduction

In everyday life we cannot be separated from thinking activities. One of the thinking activities needed in everyday life is critical thinking. Critical thinking makes one analyze their own thoughts to ensure that they have choices and can draw conclusions or decisions in their lives. Therefore, people who cannot think critically cannot decide for themselves what they think, what to believe and how they will act.

Critical thinking in Mathematics is very important to solve mathematical problems. In solving mathematical problems one must be able to search for keywords and sort information so that it becomes meaningful. In addition, a person must be able to find a solution by thinking of the reason why the settlement uses the way they think, why the step is taken, so that they can make a decision to act according to what they believe. According to Siswono in Rasiman (2015) the ability to solve mathematical problems is influenced by several factors, namely internal and external factors. Internal factors include intelligence, motivation, interests, talents and mathematical abilities. Internal factors such as learning facilities, infrastructure, media, curriculum, teachers or mentors and others. Students with different mathematical backgrounds and abilities also have different abilities in solving mathematical problems. To design a mathematical problem that can improve critical thinking skills, the teacher must understand correctly what goals to be achieved and what indicators will be developed (Adinda, 2016).

Experts reveal, in critical thinking a person will involve other cognitive abilities including the ability to interpret, analyze, synthesize, evaluate, give reasonable reasons, explain, conclude and decide an action (Ennis, 1995; Facione, 2013; Gokhale, 1995; Hendriana et al., 2017). If someone can do all of these cognitive abilities, then it can be said that the level of critical thinking ability of the person is more than someone who is only able to interpret and analyze data or one of the cognitive abilities mentioned. Therefore, it can be said that there is a level of critical thinking ability in everyone. The difference in the level of critical thinking skills of each person can be demonstrated through a series of measures of the highest level of critical thinking ability to the lowest. This paper will explain the level of students' critical thinking in solving mathematical problems.

2. Literature Review

a. Critical Thinking

The critical word comes from the Greek language *kritikos* and *kriterion* (Paul, Elder, & Bartel in Adinda, 2016). *Kritikos* means 'consideration', and *kriterion* means 'standard size' or 'standard'. Thus etymologically critical thinking is a mental activity carried out to be able to give consideration by using certain measures or standards.

Kuswana (2011) argues that critical thinking is formulating the best solution of a complex problem, thinking about what actions should be taken, analyzing the assumptions and methods used to test the hypothesis. In line with this opinion, Gokhale defines the term critical thinking as a thinking activity that involves the ability to analyze, synthesize, and evaluate concepts (Hendriana et al., 2017). In critical thinking, someone is doing activities to manipulate data or information that becomes more meaningful. In critical thinking, many abilities are empowered, namely understanding, remembering, distinguishing, giving reasons, reflecting on interpreting, analyzing, looking for relationships and evaluating.

The ability to think critically according to Ennis in Zarkasyi (2017) is the ability to think in solving mathematical problems involving mathematical knowledge, mathematical reasoning, and mathematical proof. Ennis (1996) reveals that there are six elements of critical thinking abbreviated to FRISCO as follows.

1) F (*Focus*) : Find focus or core of available problems.
2) R (*Reason*) : Knowing the reasons that support.
3) I (*Inference*) : Make reasonable conclusions and accepted data.
4) S (*Situation*) : Understanding the situation, it can make it easier to find the focus of the question and find out key terms in the problem.
5) C (*Clarity*) : Explain the meaning or purpose of an answer or settlement.

6) O (*Overview*) : Step back or examine thoroughly the decisions taken.

In line with the critical thinking elements proposed by Ennis, Facione (2013) states that in critical thinking contains several cognitive abilities, namely as follows.

1) *Interpretation*: To understand and express the meaning of various situations, data, experiences, and rules.
2) *Analysis*: To identify relationships between sentences, questions, concepts, descriptions, and representations in other forms containing meaningful information and opinions.
3) *Evaluation*: To assess the credibility of a sentence or statement and assess the statement as logical and reasonable.
4) *Inference*: To identify and get the elements needed to determine reasonable conclusions, to form conjectures or hypotheses and consider relevant information.
5) *Explanation*: Describe well the statement that can be in the form of opinions or reasons so that the listener can understand well the intended purpose.
6) *Self Regulation*: Understand or realize the activities carried out by yourself in the critical thinking process so that they can remind themselves if there is a reason or something that is inappropriate in obtaining conclusions and making decisions.

Various opinions of the experts above have similarities in elements, cognitive abilities and indicators developed in the critical thinking process. So it can be concluded that mathematical critical thinking is a mental process that is organized and intended as a process in solving problems. The process of critical thinking can be a clue or direction in thinking to solve problems and can help find relationships between statements or data accurately. Therefore, the process of critical mathematical thinking is very necessary in solving problems or finding solutions to a problem that is available in topics or subject matter of Mathematics.

b. Taxonomy of Thinking

There are six levels of thinking according to Bloom's taxonomy, namely (a) knowing is a thought process that is based on retention (storing) and retrieval (re-issuing) some knowledge that has been heard or read; (b) understanding is a more complex process of thinking that has the ability to interpret, interpret, extrapolate, and associate; (c) applying is the ability to apply knowledge, facts, theories, etc. to conclude, estimate, or resolve a problem; (d) analyze that is the ability to describe a concept or principle in its parts or components; (e) synthesizing is the ability to make a generalization or abstraction from a number of facts, data, phenomena, etc .; and (f) evaluating (evaluation) also called intellectual judgment, which is broad knowledge and deep understanding of what is known and analytical and synthesis capabilities so that it can provide an evaluation. In other words, the accumulation of all thinking abilities below is the ability to judge (Kuswana, 2011).

Therefore, even the critical thinking component is one of the elements in the taxonomy of thinking according to Bloom above. Educational research has identified several skills related to critical thinking abilities, namely finding analogies and other relationships between information, determining the relevance and validity of information that can be used to solve problems, and determine and evaluate solutions or alternative ways of completion (Pott, 1994)..

3. Methodology

This article was written using a literature study method on the topic raised. Literature study according to Nazir (1988) is a data collection technique by reviewing various books, literature, notes, and various reports relating to the problem to be solved. Whereas according to Sarwono (2006) the study of literature is studying various reference books and the results of previous similar studies which are useful to obtain a theoretical basis for the problems to be studied. Based on the understanding according to the experts above, this article will discuss critical thinking and the level of critical thinking in mathematics lessons obtained from several sources that support the topic of critical thinking in Mathematics.

4. Result and Discussion

In addition to some of the literature revealed in the above literature review subchapter on critical thinking and taxonomy of thinking, there are studies that support the topic raised by the author,

namely the level of critical thinking of students, especially in Mathematics. Research to determine the level of critical thinking in problem solving in Mathematics lessons was conducted by Rasiman in 2011 and 2015. The Rasiman Research in 2011 entitled "*Leveling of Students Critical Thinking Abilities in Mathematics In Line With Gender Differences Solving Problems*" stated that the research subjects were students at the high school level based on gender, have different levels and criteria for the ability to think critically in solving mathematical problems. The results of this study are (1) level 4 critical thinking skills (very critical): for female students, can solve problems with answers that match the correct stages of Polya and be more careful and re-check the results obtained; for male students, can solve problems with answers that are in accordance with the correct stage of Polya but not thorough and do not re-check the results that have been obtained, (2) level 3 critical thinking skills (critical): for female and male students The man, in planning the solution, tends to try first, and finally gets the right answer; for female students still re-examining the results obtained, but male students do not, (3) level 2 critical thinking skills (less critical): for female and male students able to plan and write the formula to be used, but the results problem solving is not right.

Rasiman also conducted research in 2015, namely "*Leveling of Critical Thinking Abilities of Students of Mathematics Education in Mathematical Problem Solving*" with research subjects of Mathematics Education students. The results of this study are that there are four levels of critical thinking in students, namely (1) non-critical students (LCTA-0), only able to identify available facts, (2) students with little critical thinking (LCTA-1), able to identify problems provided and can link the material of the prerequisites that have been learned with the problems that are available but not completely precise, (3) critical students (LCTA-2), can identify problems correctly, state the appropriate prerequisite knowledge to be used in solving problems, but the problem solving steps are still less accurate, (4) students are very critical (LCTA-3), can identify problems clearly, mention the required prerequisite knowledge, and can solve problems based on concepts and ideas in the form of clear and relevant procedures.

Based on the research that has been done, it is proven that the ability to think critically of each person is different from each other despite having gone through the same daily learning process. The difference in critical thinking ability can be categorized so that it forms groups with their respective criteria at each level.

5. Conclusion

From the descriptions above it can be concluded that the ability to think critically mathematically is very necessary in solving problems related to topics or material of Mathematics subjects. In the process of critical thinking there are various cognitive abilities that are used and developed. Based on the study of literature that has been disclosed above, that in each person has a level or level of critical thinking that is different. The level of critical thinking skills of each person can be grouped with certain criteria at each level.

The results of grouping level of critical thinking skills with each criterion can be used as a reference in choosing a model or learning strategy that is in accordance with the level of critical thinking of students. In addition, the results of grouping in the form of these levels can be used as a reference to compile problem solving problems in Mathematics that can develop students' critical thinking skills.

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