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Students' Critical Thinking in Solving Geometry Problems Based on Honey & Mumford's Learning Styles

Miswanto *) & Muniri
Universitas Islam Negeri Sayyid Ali Rahmatullah Tulungagung
Jl. Mayor Sujadi Timur No.48, Plosokandang, Tulungagung, Jawa Timur, Indonesia

Abstract

The purpose of this study is to describe students' critical thinking in solving geometry problems based on Honey and Mumford's learning styles. The research approach is qualitative research with a descriptive exploratory research type. The subjects in this study were students of the Mathematics Education Department, Faculty of Tarbiyah and Teacher Training, UIN SATU Tulungagung, semester 1. First, the critical thinking of subjects in solving geometry problems based on the learning styles of activist and reflective groups is in the fairly critical category. Second, the critical thinking of subjects in solving geometry problems based on the reflective group learning style and category theory is quite critical. Third, the subject's critical thinking in solving geometry problems is based on the learning styles of the theoretical and pragmatic groups in the critical category. Fourth, critical thinking of subjects in solving geometry problems based on the learning styles of the pragmatic and activist groups in the critical category
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Keywords: Critical Thinking, Problem Solving, Honey and Mumford Learning Styles

(*) Corresponding Author: miswanto_uinsatuta@yahoo.com

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INTRODUCTION

Currently, we are entering an increasingly advanced era marked by rapid changes in various areas of life, mainly the use of various artificial intelligence, or what experts call artificial intelligence. This era by Professor Klaus Schwab is called the Industrial Revolution 4.0 (Nur, 2013). In the Industrial Revolution 4.0 era, according to Wagner, there are seven types of life skills needed in the 21st Century, namely (1) critical thinking and problem-solving skills, (2) collaboration and leadership, (3) agility and adaptability, (4) initiative and entrepreneurial spirit, (5) the ability to communicate effectively both orally and in writing, (6) being able to access and analyse information, and (7) having curiosity and imagination (Wagner, 2010).

Of the seven types of life skills needed in the 21st century, the most interesting to study are critical thinking and problem-solving skills (Zakiah & Lestari, 2019). Critical thinking skills are essential skills for life, work, and functioning effectively in all other aspects of life (Samura, 2019). Critical thinking skills are thinking skills that are initiated and processed by the left brain (Fisher, 2008). Critical thinking has long been a primary goal in education since 1942. Research and various opinions about it have been a topic of discussion in the last ten years (Achmad, 2023).

According to Ennis, as quoted by Alec Fisher, critical thinking is reasonable and reflective thinking that focuses on deciding what to believe or do (Fisher, 2008). Critical

thinking is a cognitive skill and intellectual disposition to identify, analyse, and effectively evaluate arguments and truth tests to find and draw conclusions by formulating and presenting convincing reasons with the aim of making reasonable decisions (Carson, 2007). Among the most important of critical thinking are clarity, precision, accuracy, relevance, consistency, logical truth, completeness, and fairness (Bashham, 2011). Glaser also expressed critical thinking as a skill that applies logical examination and reasoning methods. Critical thinking skills are very important for students to master so that students are more skilled in constructing an argument, checking the credibility of sources, or making decisions. One of the tools to develop students' critical abilities is mathematics (Glaser, 2022).

The theory of critical thinking stages experts mostly includes five stages, namely basic clarification, further/in-depth clarification, inference, assessment, and strategy/tactics (Warda, 2011: 34). Jacob and Sam (2008) define four stages of the critical thinking process, namely (1) Clarification, namely the stage where students formulate problems precisely and clearly; (2) Assessment, namely the stage where students find important questions in the problem; (3) Inference, namely the stage where students make conclusions based on the information that has been obtained; and (4) Strategy, namely the stage where students think openly in solving problems.

Based on the explanation of critical thinking above. The aspects of critical thinking skills used in this study are as follows: 1) Skills in providing simple explanations, with indicators: formulating questions and limiting problems; 2) Skills in providing further explanations, with indicators testing data and analysing various opinions with bias, 3) Skills in arranging strategies and tactics, with indicators, avoiding highly emotional considerations and avoiding oversimplification, and 4) Skills in concluding and evaluating, with indicators: considering various interpretations and tolerating ambiguity (Ennis, 1985).

Keynes (2008) stated that the purpose of critical thinking is to try to maintain an 'objective' position. When thinking critically, you will weigh all sides of an argument and evaluate its strengths and weaknesses. So, critical thinking skills require actively seeking all sides of an argument and testing statements from claims made from the evidence used to support the claim. The most important thing about critical thinking is how the arguments we put forward are truly objective (Perkins & Murphy, 2006). Johnson E, a pioneer of contextual teaching-learning, also promoted critical thinking. Johnson E (2006) argues that students who have adequate critical thinking skills are more likely to be able to study problems systematically, face millions of challenges in an organised way, formulate innovative questions, and design solutions that are considered relatively new. With critical thinking skills, a person is able to think rationally and logically in receiving information and systematically in solving problems (Amani, 2023).

However, in reality, the cognitive development of students aged 18±22 years is included in the formal operational growth stage. During this period, adolescents already have their mindset in an effort to solve complex and abstract problems (Desmita, 2009). Adolescents' thinking abilities develop so that they can easily imagine many alternative solutions to problems along with possible consequences or results (Ben, 2020). The capacity to think logically and abstractly develops so that they are able to think multidimensionally like scientists. Adolescents no longer accept information as it is but will process the information and adapt it to their thoughts. Adolescents are also able to integrate past and present experiences to be transformed into conclusions, predictions, and plans for the future (Ramdani, 2018). With this formal operational ability, adolescents are able to adapt to their surroundings. According to Desmita (2009), the abilities possessed at the formal operational stage include: (1) Abstract thinking, namely adolescents are no longer limited to actual things, as well as experiences that actually

happened; (2) Flexible and complex thinking; namely teenagers are able to find alternative answers or explanations about something; (3) Logical thinking, namely teenagers have begun to be able to make plans to solve problems, draw conclusions and test problem solving systematically. This is also based on the trial of research questions conducted by researchers by providing a test in the form of 1 computational thinking question, as in Figure 1.

Soal Uji Coba

Suatu daratan akan dibuat penampungan air dengan ukuran panjang 50 *m* dan lebar 20 *m* serta kedalaman air pada ujung yang paling dangkal 5 *m* dan terus melandai 10 *m* sampai ujung yang paling dalam. Berapa literkah air yang terdapat pada penampungan air tersebut? Tuliskan alasanmu dengan jelas dan terperinci !

Figure 1. Trial Questions

The trial data for the research questions are test answers, think-aloud results, and semi-structured interview results of the subjects based on the stages of critical thinking, namely the stage where students think in terms of clarification, assessment, inference, and strategy. One of the test answers that students have worked on is shown in Figure 2.

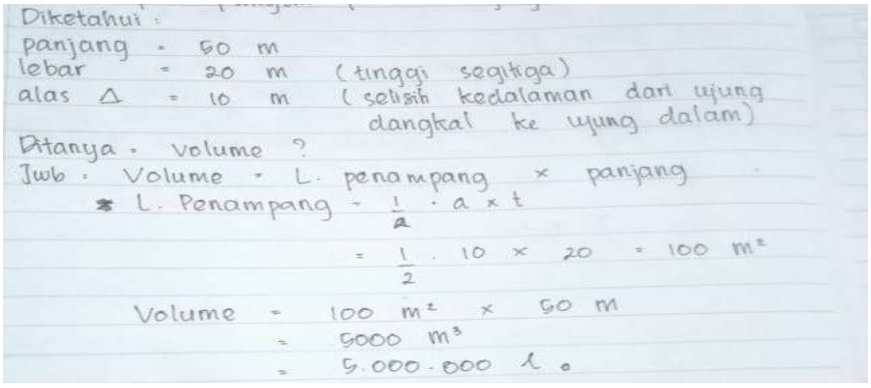

Figure 2. Answers to Trial Questions

The trial of the research test questions shows that critical thinking skills are necessary for every student to be able to face problems, especially mathematical problems. According to Paul and Elder (2007), a person who thinks critically is able to raise vital questions and problems and formulate them clearly and precisely. This is what makes critical thinking skills very necessary for every student to be able to face problems, especially mathematical problems (Rachmantika, 2019).

The critical thinking process can shape students to be able to formulate problems and their solutions so that the solutions obtained can be represented (Jacob & Sam, 2008). It can be said that critical thinking has four stages, namely clarification, assessment, inference, and strategy. The four stages of critical thinking can minimise errors when solving problems so that, in the end, a solution with the right conclusion will be obtained (Norris & Ennis, 2019). This strategy can develop students' abilities in logical thinking skills, improve problem-solving abilities in abstract concepts, improve accuracy, discipline, and analytical skills, and help in making decisions from various perspectives carefully, thoroughly, and logically (Perkins & Murphy, 2006).

Based on the problems and facts above, it is necessary to examine how students think critically when solving geometry problems based on the Honey & Mumford

learning style. This is based on the results of observations and interviews of researchers when conducting a research trial on June 19, 2024, on several subjects about critical thinking in solving sequence problems reviewed from the Honey & Mumford learning style. The results of the study showed that students' computational thinking abilities in each learning style are diverse.

The conclusion is that the results of observations and trials conducted on critical thinking with the four indicators above still need to be improved. Therefore, there needs to be critical thinking skills training for students based on their previous abilities. This is because the thinking process and initial knowledge of students are fundamental things that every student must have in solving mathematical problems so that they will be able to solve problems and think and compile problem-solving according to the stages of critical thinking based on the Honey & Mumford learning style.

Learning style is one of the ways that each individual absorbs, organises, and manages the information received (Pashler et al., 2008). The appropriate learning style is the key to student success in learning (Rudini & Saputra, 2022). Therefore, a teacher needs to understand the student's learning styles first so that learning can run effectively and efficiently (Roswewell, 2005). Many types of learning styles have developed, according to experts, one of which is the learning style according to Honey and Mumford, which divides students with their learning styles into four, namely the activist group, the reflector group, the theorist group, and the pragmatist (Honey & Mumford, 1989).

Honey & Mumford's learning style can support students in improving their critical thinking skills, including developing their critical thinking skills (Sumarmo, 2010). This is in accordance with Glaser's opinion, which defines critical thinking as an attitude to think deeply about problems and things that are within the scope of a person's experience (Fisher, 2008). Glaser also expressed critical thinking as a skill to apply logical examination and reasoning methods (Glaser, 2020). Critical thinking skills are very important for students to master in order to be more skilled in constructing an argument, checking the credibility of sources, or making decisions. One of the tools to develop students' critical abilities is mathematics (Fischer, 2009).

Previous research from Sulistiani (2016) in the national seminar proceedings stated that mathematics and critical thinking are two things that are interrelated and cannot be separated. Mathematics is understood through critical thinking, and critical thinking is trained through a series of processes in mathematics learning (Gibby, 2013). Critical thinking skills are necessary to develop in learning because critical thinking allows students to analyse their thoughts to decide on a choice and draw conclusions (Dimyati, 2015).

Johnson E, a pioneer of contextual teaching-learning, also promoted critical thinking. Johnson E argues that students who have adequate critical thinking skills are more likely to be able to study problems systematically, face millions of challenges in an organised way, formulate innovative questions, and design solutions that are considered relatively new (Johnson, 2006). Milton Keynes also conducted a study on critical thinking activities, one of which was writing with critical opinions. Writing critically is writing a text that can critically express your ideas. This means that the writing shows an understanding of the importance of an argument or perspective, the relevance of the evidence and the strength of the conclusions made (Milton Keynes: 2008).

Students' critical thinking skills in each learning style have different levels, so they can develop their critical thinking skills in mathematics through external stimulation (Setiana, 2020). Critical thinking can improve the ability to understand a problem more deeply and find ideas to solve the problem (Putri & Sobandi, 2018). In addition, critical thinking can help people make decisions rationally about what they believe (Slavin, 2008). So, critical thinking skills can help someone make good decisions (Susilowati,

Sajidan, and Murni 2018). Critical thinking skills are closely related to cognitive processes and mental activities to gain knowledge (Maryam, 2020). Critical thinking skills can train someone to reason and integrate their knowledge in order to analyse facts, create and defend ideas, make comparisons, and draw conclusions to solve problems (Abd. Ghofur, Durrotun Nafisah, 2016).

Murtiyasa et al., in their research, showed that learning styles, critical thinking, and academic performance are significantly related to each other. Given the increasing importance of critical thinking in improving individual professional competence, it is advisable to use teaching methods that are consistent with learning styles because they will be more effective in this context (Murtiyasa et al., 2019). Ennis (2011) stated that critical thinking involves a logical and comprehensive thinking process used to determine appropriate beliefs or actions (Arini & Rahayu, 2023). Critical thinking involves logical reasoning and a systematic approach to understanding the relationship between ideas or facts.

From the various research results on critical thinking above, there has been no research that reviews or discusses the description of students' critical thinking in solving geometry problems based on Honey & Mumford's learning style. In this case, the strategy or steps taken are the critical thinking process in solving geometry problems based on Honey & Mumford's learning style. So, the purpose of this study is to describe students' critical thinking skills in solving geometry problems based on Honey and Mumford's learning style.

METHODS

This research approach is qualitative research with a descriptive exploratory research type. This study uses a qualitative research approach because the research is used to explore a social phenomenon or process (Creswell, 2014), which is described according to the facts in the field without any manipulation (Sagala et al., 2019). The learning styles of the research subjects are subjects with activist, reflector, theorist, and pragmatist group learning styles (Penger & Tekavcic, 2009) in solving geometry problems by doing critical thinking. The research data used are the results of geometry problem-solving answer sheets with the think-aloud process and transcriptions of think-aloud results. The research data were analysed using a qualitative approach to describe students' critical thinking in solving geometry problems based on Honey & Mumford's learning styles.

The subjects in this study were students of the Mathematics Education Department, Faculty of Tarbiyah and Teacher Training, UIN SATU Tulungagung, semester 1. The selection was because, in semester 1, it was indicated that the critical thinking process needed to be examined in solving mathematical problems based on the experience they had while studying at the high school level. The subjects of the study were not selected randomly. However, they were selected by considering the critical thinking process and its communication so that the disclosure of the critical thinking process could be carried out properly.

The subjects used were students who could solve mathematical problems (research instruments). Fifty students were given the test. Of the 50 students, only a few students met the criteria to become research subjects. The critical thinking process was carried out for several subjects. The stages of critical thinking will later be analysed based on Honey & Mumford's learning style, which includes activist, reflector, theorist, and pragmatist groups.

RESULTS & DISCUSSION

Results

This study describes the critical thinking of students majoring in mathematics education, FTIK UIN Sayyid Ali Rahmatullah Tulungagung, in solving geometry problems based on the Honey & Mumford learning style. This section presents the subject data in solving mathematical problems that give rise to the critical thinking process. These subjects carried out the stages of clarification, assessment, inference, and strategy, where the subjects were selected based on the results of a questionnaire given to several prospective subjects. Where the selected subjects were seen from 4 learning styles, namely the activist group, the reflector group, the theory group, and the pragmatic group.

However, in selecting subjects, several subjects had a combination of learning styles, namely the activist and reflective group, the reflective and theoretical group, the theory and pragmatic group, and the pragmatic and activist group. The subjects with the activist and reflective group learning style were 12 students with critical thinking based on the activist and reflective group learning style type 1, as many as five students with critical thinking based on the activist and reflective group learning style type 2, and as many as seven students. Subjects with reflective and theoretical group learning styles were 19 students with critical thinking based on reflective and theoretical group learning styles. Type 1 consisted of 8 students, and with critical thinking based on reflective and theoretical group learning styles, type 2 consisted of 11 students. The subjects with theoretical and pragmatic group learning styles were 11 students who used critical thinking based on theoretical and pragmatic group learning styles. Type 1 consisted of 7 students, and with critical thinking based on theoretical and pragmatic group learning styles, type 2 consisted of 4 students. Subjects with pragmatic and activist group learning styles were eight students with critical thinking based on pragmatic and activist group learning styles. Type 1 consisted of 6 students, and with critical thinking based on pragmatic and activist group learning styles, type 2 consisted of 2 students.

Discussion

Students' Critical Thinking in Solving Geometry Problems Based on the Learning Styles of Activist and Reflective Groups

The subject understands the problem by reading and obtaining known information, namely, a water container above is in the form of a prism with a trapezoidal base. To determine how many litres of water are in the water container, the formula for the volume of a prism with a trapezoidal base can be used. $V = Base\ area\ x\ Height\ of\ prism = \left(\frac{(a+b)}{2}.t\right) x\ t_{prisma}$, with known $a = 5\,m$ & $b = 10\,m$. Where the subject is able to formulate the problem based on the given question, which is critical thinking through the clarification stage. This is because, at the clarification stage, the subject can mention the information known in the question precisely and clearly, and the subject can mention the question asked correctly from the question (Warda, 2011).

The subject plans a strategy when getting information about how many litres of water are in the water reservoir, so the subject uses the formula V = Base area x Height of the prism. $= \left(\frac{(a+b)}{2}.t\right) x\ t_{prisma}$ (Keynes, 2008). Where the subject is able to find important questions in the problem, which is in the subject in critical thinking through the

assessment stage. This is because, during the assessment stage, the subject is able to decide on credible sources and create and assess the results of their observations so that they can plan solutions (Norris & Ennis, 2019).

Subjects in implementing a solution strategy with mathematical calculations based on the volume formula for a prism with a trapezoid base $V = \left(\frac{(5+10)}{2}.50\right) x\ 20 = 7.500\ x\ 20 = 7.500.000$. Where the subject is able to find important questions in the problem, which is in the subject in critical thinking through the inference stage. This is because the subject at the inference stage is able to describe the right conclusion with deduction and induction, generalise, explain and make hypotheses (Perkins & Murphy, 2006).

The subject in making conclusions and checking them again by mentioning $V = 7.500.000\ m^3 = 7.500.000\ liter$ Moreover, the subject concluded that the amount of water in the water reservoir was 7,500,000 litres. The subject was able to draw conclusions based on the information that had been obtained, which was done through critical thinking during the inference stage. This is because the subject at the inference stage was able to analyse and draw conclusions (Jacob & Sam, 2008).

The interesting thing that we can observe is the absence of critical thinking in subjects through the stages of strategy in subjects with reflective and theoretical group learning styles. The subjects do not think openly about solving the problems given; this is because the subjects do not use critical thinking skills with the subject's cognitive strategy of thinking about and analysing to get the right conclusion (White, 2010).

Students' Critical Thinking in Solving Geometry Problems Based on Reflective and Theoretical Group Learning Styles

Subjects understand the problem by reading and obtaining known information, namely a water reservoir if the sketch is drawn forming a prism with a trapezoid base, then to find out how many litres of water is in the reservoir. When the subject is able to formulate the problem precisely and clearly based on the questions given, the subject goes through the clarification stage in critical thinking. This is because, at the clarification stage, the subject is able to understand the problem and ask and answer questions to achieve general clarification of a problem (Norris & Ennis, 2019).

Subjects in planning a strategy when getting information from the question of how many litres of water are in the water reservoir, so that the subject writes down several known elements by mentioning ($a\ =\ 5\ m$) Side 1 of the trapezium is 5, and side 2 of the trapezium is 10 ($b\ =\ 10\ m$), then the height of the trapezium is 50 ($a\ =\ 50\ m$). Finally, the height of the prism is 20 ($a\ =\ 20\ m$). When the subject is able to find important questions in the questions given, which is critical thinking, the subject goes through the assessment stage. This is because the subject at the assessment stage is able to put forward facts of arguments or connect problems with other problems (Perkins & Murphy, 2006).

Subjects in implementing a solution strategy with mathematical calculations based on the volume formula for a prism with a trapezoid base $V = \left(\frac{(5+10)}{2}.50\right) x\ 20 = 7.500\ x\ 20 = 7.500.000$. When the subject can make conclusions based on the information obtained, the subject goes through the inference stage in critical thinking. This is because the subject at the inference stage is able to make and decide conclusions deductively and inductively (Norris & Ennis, 2019).

The subject makes conclusions and checks them again by mentioning $V = 7.500.000\ m^3 = 7.500.000\ litres$. Moreover, the subject concludes that the amount of water in the water reservoir is 7,500,000 litres. When the subject can make conclusions

based on the information obtained, the subject goes through the inference stage in critical thinking. This is because the subject at the inference stage is able to make conclusions based on the information obtained by combining relevant information and then making generalisations (Jacob & Sam, 2008).

An interesting thing that can be noted is the absence of critical thinking at the strategy stage in critical thinking in subjects with reflective and theoretical group learning styles. The subjects do not think openly about solving the problems given; this is because the subjects at the strategy stage in the subjects have personal biases that make them subjects not open-minded. This bias can cause the subject to not use experience, reasoning, and analysis to conclude (Arylien, 2014).

Students' Critical Thinking in Solving Geometry Problems Based on Theoretical and Pragmatic Group Learning Styles

Subjects in understanding the problem by reading and obtaining known information by describing a water reservoir whose image forms a trapezoidal prism. Where the subject does not formulate the problem based on the questions given, in critical thinking, the subject does not go through the clarification stage. This is because, at the clarification stage, the subject is able to state, clarify, describe or define the problem (Perkins & Murphy, 2006).

Subjects in planning a strategy when getting information from the question of how many litres of water are in the water reservoir, so that the subject writes it down. Where the subject is able to find important questions in the questions given and is able to write the formula for the volume of the trapezoidal base prism, namely $V = Base\ area\ x\ Height\ of\ prism = \left(\frac{(a+b)}{2}.t\right) x\ t_{prisma}$, Where the subject finds important questions in the formulation of the problem, which, in critical thinking, students go through the assessment stage. This is because the subject at the assessment stage is able to sort out information from the questions needed to solve the problem with information that is not needed to solve the problem; students can find important questions in the problem (Warda, 2011).

Subjects in implementing a solution strategy with mathematical calculations based on the volume formula for a prism with a trapezoid base $V = \left(\frac{(5+10)}{2}.50\right) x\ 20 = 7.500\ x\ 20 = 7.500.000$. When the subject can make conclusions based on the information obtained, the subject goes through the inference stage in critical thinking. This is because the subject at the inference stage is able to make conclusions based on the information obtained by combining relevant information and then making generalisations (Jacob & Sam, 2008).

The subject in making conclusions and checking them again by mentioning $V = 7.500.000\ m^3 = 7.500.000\ liter$ Moreover, the subject concludes that the amount of water in the water reservoir is 7,500,000 litres. Where the subject is able to make conclusions based on the information that has been obtained, in critical thinking, the subject goes through the semi-inference stage. This is because the subject at the semi-inference stage is able to think deductively and inductively, generalise, explain and make hypotheses (Perkins & Murphy, 2006).

The subject in solving the problem by giving reasons in the answering process, namely writing that the water container is drawn in the form of a trapezoidal prism to find its volume, then the base area (area of the trapezoid) is multiplied by the height of the prism. Then, the subject is also able to conclude and recheck the answer; this is based on the subject's explanation that he has rechecked the answer and also wrote that the unit uses meters, so it must be changed to litres where $dm^3 = liter$ and m^3 to dm^3 Cros

1.000. When the subject is able to think openly when solving problems and when critical thinking is used, the subject goes through the strategy stage. This is because the subject at the strategy stage is able to evaluate the solutions that have been made and look for other alternative solutions (Norris & Ennis, 2019).

Students' Critical Thinking in Solving Geometry Problems Based on Pragmatic and Activist Group Learning Styles

Subjects understand the problem by reading and obtaining known information by describing a water reservoir whose image forms a prism with a trapezoid base. In the question, several elements are known by the subject, such that the parallel sides are 5 m and 10m, the height of the trapezium is 50 m, and the height of the prism is 20 m. When the subject is able to formulate the problem based on the questions given, the subject goes through the clarification stage in critical thinking. This is because, at the clarification stage, the subject is able to identify terms and definitions and determine the context of the definition based on the right reasons so that they can evaluate the planned solution (Norris & Ennis, 2019).

Subjects in planning a strategy when getting information from the question of how many litres of water are in the water reservoir, so that the subject writes it down. Where the subject is able to find important questions in the questions given and is able to write the formula for the volume of the trapezoidal base prism, namely V= $Base\ area\ x\ Height\ of\ prism =$ $\frac{1}{2}\ x\ number\ of\ parallel\ sides\ x\ height\ of\ trapezium\ x\ height\ of\ prism\ = \left(\frac{(a+b)}{2}.t\right) x\ t_{prisma}$. When the subject is able to find important questions in the problem and determine the right formula used in solving the problem, in critical thinking, the subject goes through the clarification stage and the assessment stage. This is because the subject at the assessment stage is able to analyse information by identifying relevant information, finding important questions in the problem, determining logical reasons that support the information, and then proposing a solution (Jacob & Sam, 2008).

Subjects in implementing the solution strategy with mathematical calculations based on the formula for the volume of a prism with a trapezoid base $V = \left(\frac{(5+10)}{2}.50\right) x\ 20 = 7.500\ x\ 20 = 7.500.000$. When the subject can make conclusions based on the information obtained, the subject goes through the inference stage in critical thinking. This is because the subject at the inference stage is able to use relevant information in the problem and or previous knowledge obtained to solve the problem and explain how each existing information is related (Warda, 2011).

The subject in making conclusions and checking them again by mentioning $V = 7.500.000\ m^3 = 7.500.000\ liter$ Moreover, the subject concludes that the amount of water in the water reservoir is 7,500,000 litres. Where the subject is able to make conclusions based on the information that has been obtained, in critical thinking, the subject goes through the semi-inference stage. This is because the subject at the semi-inference stage is able to find steps to solve the problem and can draw conclusions correctly (Norris & Ennis, 2010).

The subject solves the problem by providing reasons in the answering process, namely writing that the dimensions presented in the question, the water reservoir is in the form of a prism with a trapezoidal base and then calculated using the formula for the volume of a trapezoidal prism, the result of which is 7.500 m^3. Because the command in the question is conventionalised in litres, where each 1 m^3 equals 1.000 litres, so 7.500 $m^3\ x\ 1.000 = 7.500.000\ litres$. So the amount of water in the water reservoir is

7,500,000 litres. When the subject is able to think openly when solving problems, in critical thinking, the subject goes through the strategy stage. This is because the subject at the strategy stage thinks openly about solving problems by evaluating the steps and results of problem-solving and determining other solutions to solving problems (Jacob & Sam, 2008).

CONCLUSION

Based on the results of research and discussion on students' critical thinking in solving geometry problems based on Honey & Mumford's learning styles, there are four groups of learning styles in students' critical thinking in solving geometry problems namely ***First,*** the critical thinking of subjects in solving geometry problems based on the learning styles of activist and reflective groups starts from the step of understanding the problem by thinking critically through the clarification stage, the step of planning a strategy in critical thinking through the assessment stage, the step of implementing a strategy in critical thinking through the inference stage, the step of concluding and rechecking in the critical thinking stage includes the inference stage, but in critical thinking the subject does not go through the strategy stage. Where the critical thinking of students is in the fairly critical category. ***Second,*** the critical thinking of subjects in solving geometry problems based on the learning style of the reflective and theoretical groups starts from the step of understanding the problem by thinking critically through the clarification stage, the step of planning a strategy in critical thinking through the assessment stage, the step of implementing a strategy in critical thinking through the inference stage, the step of concluding and rechecking in the critical thinking stage includes the inference stage, but in critical thinking the subjects do not go through the strategy stage. Where the critical thinking of students is in the fairly critical category. ***Third,*** the critical thinking of subjects in solving geometry problems based on the learning styles of theoretical and pragmatic groups starts from the step of understanding the problem by thinking critically through the clarification stage, the step of planning a strategy in critical thinking through the assessment stage, the step of implementing a strategy in critical thinking through the inference stage, the step of concluding and rechecking in the critical thinking stage including the inference stage, and in solving the problem the subject provides reasons in answering through the strategy stage. Where the critical thinking of students is in the critical category. ***Fourth,*** the critical thinking of subjects in solving geometry problems based on the learning styles of pragmatic and activist groups starts from the step of understanding the problem by thinking critically through the clarification stage, the step of planning a strategy in critical thinking through the assessment stage, the step of implementing a strategy in critical thinking through the inference stage, the step of concluding and rechecking in the critical thinking stage including the inference stage, and in solving the problem the subject provides precise and clear reasons in answering through the strategy stage where the critical thinking of students is in the critical category.

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