

# **THE EFFECT OF THINK-TALK-WRITE COOPERATIVE LEARNING ASSISTED BY GEOGEBRA SOFTWARE ON STUDENTS' CRITICAL THINKING (CASE STUDY OF SMA AL-HIDAYAH MEDAN)**

**Ahmad Rahmatika**<sup>1</sup>

<sup>1</sup> Universitas Muhammadiyah Sumatera Utara, Medan, Indonesia

<sup>1</sup> Email: [ahmadrahmatika@umsu.ac.id](mailto:ahmadrahmatika@umsu.ac.id)

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## **ABSTRACT**

This study aimed to see or describe the effect of cooperative learning type think talk write assisted by GeoGebra software on students' critical thinking at SMA Al-Hidayah Medan. In the current learning period, there are still many students who use the memorization learning method, without knowing how the formula process actually works. Certainly, there is no student's ability to think critically to make them understand the formulas given by the teachers. This study used a quantitative approach, with the SPSS analysis tool and the ANOVA test. The results obtained that the group score of the GeoGebra-assisted TTW learning model and the ordinary learning model obtained a value of  $F_{count} = 9.406 > F_{table} = 3.140$  and with  $sig = 0.003$ . Because the sig level is less than 0.05, so  $H_0$  is rejected and  $H_1$  is accepted. So it can be concluded that there is an effect of using the TTW type cooperative learning model with the help of GeoGebra software on students' mathematical critical thinking skills.

## 1. INTRODUCTION

Mathematical critical thinking is the ability to think in solving mathematics that involves mathematical knowledge, mathematical reasoning, and mathematical proof (Lestari, 2014:5). When critical thinking is developed, a person will tend to seek the truth of divergent thinking and can think independently. Krulik and Rudnick (NCTM 1999), suggest that critical thinking in mathematics is thinking that tests, questions, relates, and evaluates all aspects of a situation or problem. A person who thinks critically will always be sensitive to information or the situation he is facing and tends to react to that situation or information.

According to Sabandar (2008: 8), critical thinking is a generative sense that emphasizes creativity and authenticity in designing a product or creating a solution to a problem. Meanwhile, according to Glazer (2001:68) critical thinking in mathematics is the ability and disposition to involve prior knowledge, mathematical reasoning, and cognitive strategies to generalize, prove or evaluate unfamiliar mathematical situations in a reflective way. This is in line with Cabera's opinion (in Husnidar, 2014: 72) explaining that mastery of critical thinking skills is not enough to serve as a mere educational goal, but also as a fundamental process that allows students to overcome various future problems in their environment. From the opinions of the two experts above, it can be concluded that in the learning process, educators should not ignore the mastery of students' critical thinking skills.

Currently, efforts to improve mathematical critical thinking skills are still classified as not entrenched in the classroom, many students learn to use memorization of theories and formulas without communicating and thinking. To deal with this problem, it is necessary to make learning efforts based on cognitive theory which includes constructivist learning theory. According to constructivist theory, critical thinking can develop if students do it themselves, discover, and transfer existing knowledge complexes. In this case, students will spontaneously match their new knowledge with their existing knowledge and then rebuild their knowledge rules if there are inappropriate rules.

Developing students' thinking skills is the focus of mathematics educators in the classroom. According to Sabandar (2008:1), learning mathematics is closely related to activities and processes of learning and thinking because the characteristics of mathematics are a science and a human activity in which it is a pattern of thinking, a pattern of organizing logical proofs, which uses carefully defined terms, clear, and accurate. The thinking pattern in this mathematical activity is divided into two, which are low-order mathematical thinking and high-order mathematical thinking. Anderson (2004) states that when critical thinking is developed, a person will tend to seek the truth, think openly and be tolerant of new ideas, can analyze problems well, think systematically, is full of curiosity, mature in thinking, and can think critically independently.

It is important for students to have mathematical critical thinking skills, but the facts found in the field show that students' critical thinking skills are still low. The IMSTEP-JICA Survey Team (Fachrurazi, 2011:77) in the city of Bandung found that a number of activities that were considered difficult by students to learn and by teachers to teach were proving problem-solving that requires mathematical reasoning, finding, generalizing or conjectures, and finding the relationship between the data or facts given. These activities that are considered difficult are activities that require critical thinking skills. Therefore, it can be concluded from the survey results that students have difficulty when faced with problems that require critical thinking skills.

This is in accordance with the fact that occurred in the preliminary research at SMA Al-Hidayah Medan on October 16, 2015, the mathematics learning outcomes of SMA Al-Hidayah Medan students were still relatively low because they were still below the minimum proficient criteria (KKM) applied in schools which are 70. Furthermore, to see students' mathematical critical thinking skills such as giving questions about critical thinking skills with one of the indicators proposed by Ennis (1996:4), including focus and reasons, as follows: "In a house, there is a swimming pool in the shape of a circle with a central point  $P(2,3)$ , at the edge of the pool there is a path that touches perpendicular to the edge of the pool with the equation  $y=7$ . What is the equation of the circle of the pool?"

The questions given are critical thinking questions with focus and reason indicators. From the results of the student's answer process, there were 50% of students did not know the main problem in the question and formulated the main problem (focus) needed to determine the equation of the circle. Furthermore, there were 65% of students were unable to formulate arguments (reasons) based on their conceptual abilities. So it can be concluded that students have not been able to solve the problems given properly and correctly, and students do not have a varied answer process. Furthermore, based on the results of an interview with one of the mathematics teachers at the Al-Hidayah school in Medan, it was found that the teacher was still applying conventional teaching so students' critical thinking skills were lacking and students' communication skills were low which resulted in students' understanding of the material.

In providing critical thinking skills to students, it is not taught specifically as a subject but through every aspect of learning critical thinking so that every learning activity must be able to grow and improve the dimensions of understanding and skills to make them accustomed to facing problems in daily life. It is just that this habit of critical thinking has not been made a tradition in schools. According to Slavin (2003) adequate means to train

students' thinking skills and problem-solving are educational institutions such as schools. Therefore, it is concluded that the school is a mirror of the wider community and is a place (laboratory) for problem-solving from real-life forms.

The problems above eventually lead to the assessment that mathematics is a difficult and uninteresting subject to master. Students are less interested and students' motivation is low when faced with math problems, then students tend to avoid them. This is in accordance with the opinion of Abdurrahman (2003:42) who states that of the various fields of study taught in schools, mathematics is the field of study that is considered the most difficult by students, both those who do not have learning difficulties and more so for students who have learning abilities. As a result, not a few students are lazy to learn.

If this situation continues, it is feared that students will increasingly do not understand mathematics, considering that mathematics is a tiered (hierarchical) science. If they do not pass the first material, then in the next material students will be more difficult. This situation will form an opinion in the minds of students that mathematics is difficult, uninteresting, and difficult. Considering the importance of communication skills and mathematical critical thinking, both of these abilities should be developed in students.

Many factors affect students' mathematical critical thinking skills, one of which is inaccuracy and lack of variety in the use of learning models and learning media used by teachers in the classroom. The fact shows that so far most teachers use conventional learning models and are dominated by teachers. Such learning patterns must be changed by leading students to construct their own knowledge.

The learning model that is thought to be able to improve students' communication and critical thinking skills is cooperative learning. In cooperative learning, students will be more active, because there is a process of discussion or interaction between students in their groups. Through discussion activities, conversations in expressing mathematical ideas can help students develop their minds so that students who are involved in differences of opinion or find solutions to a problem can improve students' communication skills.

There are many cooperative learning models that we can use in an effort to develop these two abilities, one of the efforts that can be made to overcome these problems is to apply the Think-Talk-Write type cooperative learning model. Think-Talk-Write type cooperative learning is alternative learning that can develop students' mathematical critical thinking and communication skills. ICT assistance such as GeoGebra software can also attract students' interest in learning mathematics which they have considered boring. Based on the problems above, as well as some of the solutions mentioned earlier, the researcher tried to combine the Think-Talk-Write type of cooperative learning model, with computer technology media (GeoGebra), Think-Talk-Write type of cooperative learning has advantages at learning flow, starting from the involvement of students in thinking, speaking, and sharing ideas with their friends before writing, so the Think-Talk-Write type cooperative learning model is expected to improve students' mathematical communication.

Thinking activity can be seen from the process of reading a mathematical text or containing a mathematical story, then making notes of what they have read. According to Wiederhold (in Ansari: 2009: 70) taking notes means analyzing the purpose of the content of the text and examining written materials that can enhance students' understanding, and even improve thinking and writing skills.

After the "think" stage is complete, the next stage is "talk", which is communicating using words and language they understand. The communication phase of this strategy allows students to be skilled at speaking. Communication skills can accelerate students' ability to express their ideas through writing. This can happen when students are given the opportunity to have a dialogue or speak while constructing various ideas to put forward.

Later in the "write" phase, which is to write down the results of the discussion or dialogue on the provided worksheet (Student Activity Sheet). Writing activity means constructing ideas, because after discussing and then expressing them through writing. Writing in mathematics helps to realize one of the learning objectives, which is students' understanding of the material they are studying.

The Think-Talk-Write type learning model is very good when combined with technology media, especially in the use of GeoGebra because it can help students' mathematical critical thinking and communication skills through their investigations. GeoGebra is expected to be able to present animated and colorful images that make students more memorable and interesting so that in the learning process students can improve communication and mathematical critical thinking.

Furthermore, from the results of an interview with one of the teachers of SMA Al-Hidayah Medan, in learning mathematics there were 70% of teachers have not used computer media, especially not using supporting software. The teacher still provides information in visualizing by drawing it directly in front of the class. It takes a long time to visualize and students cannot construct their own knowledge that comes from real-world problems into mathematical form. This results in low students' mathematical thinking skills.

According to NCTM 2000 quoted by Furner (2013: 210), the use of technology in teaching mathematics should be one of the principles for teaching mathematics to students. NCTM feels that through the use of technology tools students can: a) work at a higher level of generalization, b) model and solve complex problems and c) focus

on decision making and reasoning. Using a tool like GeoGebra can really help students better understand when learning math.

Adelodun (2015: 21) states that student performance in learning Mathematics can be improved through the integration of Geogebra software in the classroom. By using GeoGebra, learning will be more effective and students can have a good response in learning mathematics so that the material can be delivered optimally and students can better understand the material (Anggroratri, 2014: 138). Furthermore, according to Suweken (2013: 284), the integration of GeoGebra-based virtual learning media in mathematics learning can increase students' motivation and learning achievement.

## LITERATURE REVIEW

According to Hassoubah (2004:88), critical thinking is the ability to give reasons in an organized manner and evaluate the quality of a reason systematically. Meanwhile, according to Husnidar (2014: 73), critical thinking is the ability to think by giving reasons in an organized manner and evaluating the quality of a reason systematically, and deciding on beliefs. According to R.H Ennis quoted by Hassobuah (2004:87), critical thinking is reasoned and reflective thinking by emphasizes making decisions about what to believe or do. From the understanding above, the writer concludes that critical thinking is a thinking activity in interpreting and evaluating a reflective reason that aims to make a decision.

Critical thinking is not the same as arguing or criticizing others. The word "critical" of an argument is not synonymous with "disagreement" with an argument or the views of others. The critical appraisal can be done on a good argument because critical thinking is neutral and unemotional. Critical thinking can also be said as a form of mental activity or an active human mind. According to Ennis (1996), critical thinking is a thinking process that aims to make rational decisions that are directed at deciding whether to believe or do something.

Meanwhile, according to Cabera in Husnidar (2014: 72), the mastery of critical thinking skills is not enough to serve as a mere educational goal, but also as a fundamental process that allows students to overcome various future problems in their environment. For this reason, in the teaching and learning process, teachers should not ignore students' mastery of critical thinking. People who think critically mathematically will tend to have a positive attitude towards mathematics, so they will try to reason and look for strategies to solve mathematical problems. Glazer in Husnidar (2014: 72), states that mathematical critical thinking is the ability and mathematical disposition to involve prior knowledge, mathematical reasoning, cognitive strategies to generalize, prove and evaluate situations mathematically. According to Hassoubah (2002:87), critical thinking can be achieved more easily if a person has dispositions and abilities that can be considered mathematical traits and characteristics.

Beyer quoted by Hassoubah (2002:93), asserts that critical thinking skills are skills to:

1. Determine the credibility of a source.
2. Distinguish between the relevant from the irrelevant.
3. Distinguishing facts from judgments.
4. Identify and evaluate unspoken assumptions.
5. Identify existing biases.
6. Identify the point of view
7. Evaluate the evidence offered to support the confession.

Meanwhile, according to Bonie and Potss (2003: 54), it can be briefly concluded that there are three strategies to teach critical thinking skills, namely: (1) Building Categories (Making Classifications), (2) Finding Problems (Finding Problems). , and (3) Enhancing the Environment. It was also mentioned that some of the characteristics of teaching for critical thinking include: (1) Increasing interaction between students and students as students, (2) By asking open-ended questions, (3) Providing adequate time for students to reflect on the questions posed or problems given, and (4) Teaching for transfer (Teaching to be able to use the abilities that have just been obtained in other situations and on the students' own experiences).

According to Murti (2014:2), the characteristics of critical thinkers are as follows:

1. Raising important questions and problems, formulating them clearly and thoroughly.
2. Generating new ideas that are useful and relevant to performing tasks. Critical thinking is considered to have an important role to assess the benefits of new ideas, choosing the best ideas, or modifying ideas if necessary.
3. Collecting and assessing relevant information using abstract ideas to interpret it effectively.
4. Drawing conclusions and solutions with strong reasons, strong evidence and testing them using relevant criteria and standards.
5. Thinking openly by using various alternative thinking systems, while recognizing, assessing, and looking for relationships between all assumptions, implications for practical consequences.
6. Being able to overcome confusion, able to distinguish between facts, theories, opinions, and beliefs.
7. Communicating effectively to others in an effort to find solutions to complex problems without being influenced by other people's thoughts on the topic in question.
8. Being honest with yourself, refusing manipulation, holding scientific credibility and integrity, and being intellectually independent, impartial, and neutral.

The essence of developing critical thinking is to access various other information from various sources that are not limited to only using textbooks, then the information is analyzed using a variety of basic knowledge

from formal teaching materials, then students make conclusions. This inference process is called critical thinking which is able to give birth to various creative thoughts.

According to Lan Wright quoted by Hassoubah (2002:97), there are several ways to improve critical thinking skills as follows:

1. Read critically.
2. Improve analytical power.
3. Develop observing skills.
4. Increase curiosity; the ability to ask questions and reflection.
5. Metacognition.
6. Observing the “model” in critical thinking.
7. Rich discussions

L.M. Sartorelli in Hassoubah (2002: 110), suggests that if someone has done acts of thinking with others in discussion forums, it can be used as a criterion for measuring accuracy and critical thinking achievement. The actions are as follows:

1. Facing challenge after challenge with reasons and examples.
2. Providing examples or arguments that are different from the existing ones.
3. Receiving views and suggestions from others to develop new ideas.
4. Finding and describing the relationship between the problem under discussion and other relevant problems or experiences.
5. Connect the specific problem that is the subject of discussion with a more general principle.
6. Asking relevant and regular questions.
7. Asking for clarification.
8. Asking for elaboration.
9. Asking the source of information.
10. Trying to understand.
11. Listening carefully.
12. Listening with an open mind.
13. Speaking freely.
14. Being polite.
15. Seeking and providing varied ideas and options

### **Mathematical Critical Thinking Indicator**

According to Ennis (1996:4), there are six indicators in critical thinking which is abbreviated as FRISCO, such:

1. Focus, on the situation that describes the main problem, can be done by asking questions like what is the real problem? What is known? How to prove it?
2. Reason, formulating arguments that support conclusions, looking for evidence that supports a reason so that conclusions can be accepted, identifying and justifying problems.
3. Conclusion (Inference), whether the reasons stated are correct or not. If yes, justify the reasons to support the conclusions that will be made.
4. Situation, thinking activity is also influenced by the environment or situation around us, understanding the situation will help clarify the problem and the meaning of key terms.
5. Clarity, this can be done by asking what it means, can you give another example, can you give another way?
6. Overall examination (Overview), re-examine what has been found, studied, decided, and concluded as a whole. Whether everything is decided logically.

Based on several expert opinions about mathematical critical thinking skills, it can be concluded that students' abilities in terms of (1) Focus, (2) Reason (formulating arguments accompanied by evidence), and (3) (Overview) Overall examination to draw conclusions accompanied by evidence and reasons and determine the correct image. The indicators of critical thinking in this study are focus, reasons, and conclusions.

### **Mathematics Learning**

Many people view mathematics as the most difficult field of study. Nevertheless, everyone should study mathematics because it is a means to solve everyday problems. According to Johnson and Myklebust (in Abdurrahman 2012:202), mathematics is a symbolic language whose practical function is to express quantitative and spatial relationships while its theoretical function is to facilitate thinking. In accordance with this, Lerner (in Abdurrahman 2012:202) argues that besides being a symbolic language, mathematics is also a universal language that allows humans to think, record, and communicate ideas about elements and quantities. Meanwhile, Abdurrahman (2012:203), suggests that mathematics is a way to find answers to problems faced by humans; a way of using information, using knowledge of shapes and sizes, using knowledge of counting, and most importantly thinking in humans themselves in seeing and using relationships.

The essence of learning mathematics is a way to find answers to problems faced by humans; a way of using information, using knowledge about counting, and most importantly thinking in humans themselves in seeing and using relationships (Abdurrahman, 2012: 203). The purpose of this learning will achieve maximum results if the learning runs effectively. According to Ellis et al (in Wahab 2009:5), effective teaching and learning is something that is very essential in the learning process. Learning must be meaningful so that it has a positive impact, especially on students. In line with that, Huda (2014: 2) states that learning is the result of memory, cognition, and

metacognition that affect understanding. A person needs to be involved in reflection and memory use to track what he should absorb, what he should store in his memory, and how he evaluates the information he has obtained by Glass and Holyak (in Huda, 2014: 2).

From the description above, it can be concluded that learning mathematics is a presentation of material that is conditioned and pursued by the teacher so that students are active and can take the positive side in the learning process and end up with a comprehensive understanding of the material that has been presented.

## 2. METHODOLOGY

This research method used a quantitative approach, using SPSS software, and ANOVA or two-way analysis. The population in this study were all students of class XI IPA SMA Al-Hidayah Medan, which amounted to 107 students consisting of 3 parallel classes. While the sample According to Arikunto (1989:123), is part of the object, thing, or person to which the researcher's variable is attached (population). However, the sampling technique in this study used a group sampling technique (Cluster Sampling). Ruseffendi (94:2005) stated that the method of taking samples was random based on groups not based on its members provided that the members of the group have the same characteristics. Therefore, XI IPA SMA Al-Hidayah Medan has the same characteristics of the number of members, such as class XI IPA (b) and XI IPA (c) with 32 students. Thus the number of samples in this study was 64 students.

## 3. RESULT AND DISCUSSION

In the theoretical study in chapter 2, critical thinking according to Ennis (1991: 6) is reasonable and reflective thinking focused on deciding what to believe or do.

The indicators measured by critical thinking skills come from the indicators presented by Ennis (1996:4), which are: (1) Focus (Focus), on situations that describe the main problem, (2) Reasons (formulating arguments accompanied by evidence), and ( 3) (Overview) Overall examination to draw conclusions accompanied by evidence and reasons and determine the correct picture.

Based on the calculation results, the mathematical critical thinking ability of students who study with the TTW learning model is higher than the mathematical critical thinking ability of students who study with the ordinary learning model. Students who take part in learning with the TTW learning model are motivated to continue to discuss and share opinions. Because the learning process is not just transferring knowledge from the teacher to students, but a process that is conditioned or pursued by the teacher, students are active in various ways to build their own knowledge.

Based on the results of data analysis, after the classroom learning using the TTW learning model and the class learning using the ordinary learning model, post-test scores were obtained for mathematical critical thinking skills in both classes. The average post-test score for mathematical critical thinking of students who learn by learning the TTW learning model is 18.98 with a high category of 20.37, a medium of 19.43, a low of 17.12, and the average score of students' mathematical critical thinking skills in students who study with conventional learning models is 17.18 with high category 18.71, medium 16.71 and low category 16.12. From the results of post-test scores calculated for both classes, the class that learns with the TTW learning model gets a standard deviation of 1.99, and the class that learns with the conventional learning model gets a standard deviation of 2.43

The results of the two-way ANOVA calculation on the group scores of the GeoGebra-assisted TTW learning model and the conventional learning model obtained the score of  $F_{count} = 9.406 > F_{table} = 3.140$  and with  $sig = 0.003$ . Because the sig level is less than 0.05, so  $H_0$  is rejected and  $H_1$  is accepted. So it can be concluded that there is an effect of using the TTW type cooperative learning model with the help of GeoGebra software on students' mathematical critical thinking skills. In accordance with relevant research, Hidayat's research (2012: 9) states that increasing students' mathematical critical thinking skills whose learning uses the TTW type cooperative learning model is better than conventional learning. This means that the cooperative learning model has an influence on students' critical thinking skills.

## 4. CONCLUSION

From the results of the discussion carried out, it can be concluded that there is an effect of using the Think Talk Write (TTW) type cooperative learning model with the help of Geogebra software on students' mathematical critical thinking skills. Then there is no interaction between learning and early mathematics abilities on students' mathematical critical thinking skills. This means that learning with this method is still unfamiliar to teachers and students, for that there needs to be socialization by schools or related institutions so that teachers and students can understand or can improve students' ability to think critically mathematically.

In the results of this study, the people of Moyoketen Village located in Tulungagung Regency have several different perspectives regarding online marriage, such as online marriages are not easy to do because it leaves the customs and culture of marriage in an area and concerns the identity and original documents that must be completed by the prospective bride and groom. However, some people in Moyoketen Village also gave positive

responses regarding the legality of online marriages as long as they are still in accordance with the religious procedures followed by the prospective brides.

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