

Students' Critical Thinking Ability Through the Application of the Creative Problem Solving (CPS) Model assisted by Autograph

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Article Info	ABSTRACT
<p>Article History Received : 14 Oktober 2022 Accepted : 26 Oktober 2022 Published : 28 Oktober 2022</p> <hr/> <p>Keywords: Critical Thinking Ability , Creative Problem Solving (CPS)</p>	<p>This study aims to examine differences in critical thinking skills between groups of students who apply Autograph-aided Creative Problem Solving learning models and students who apply Creative Problem-Solving learning models without the help of autographs and see students' positive attitudes in learning Creative Problem-Solving models. This research is experimental research at YPK Medan Private Middle School. The sample selection used as the experimental group, and the control group was carried out randomly (random cluster sampling). The instrument used was a set of tests of critical thinking skills in mathematics. The results showed that the ability to think critically in students who applied the CPS model using Autograph was better, with a percentage of mastery learning by 85.27%. In comparison, the group of students who applied the CPS model gained a percentage of mastery learning by 78.16%. There was a positive attitude of students applying the autograph-aided CPS model when learning takes place.</p> <p style="text-align: right;">This is an open access article under the CC-BY-SA license</p>



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INTRODUCTION

In today's age of technology, communication and information, the ability to think critically is essential for people to face changing circumstances or challenges in their evolving lives. Likewise, in mathematics, critical thinking skills are one of those skills that needs to be developed and improved. The learning process of the 2013 course requires the active participation of students and provides ample space for students' creativity, interests and talents (Fitri, S., et al., 2019). Critical thinking skills must be based on deep curiosity, which is necessary when dealing with existing challenges. Critical thinking is the most important asset students have when dealing with the problems they encounter in their study and daily social life (Ferrini-Mundy, J. 2000). Attention plays a crucial role in the learning process without unknowingly leading to high performance (Syahputra, E., & Utami, D. R. 2019; Lubis, R. D. 2020).

Krulik, S., & Rudnick, J. A. (1996) proposes that what is called critical thinking in mathematics is thinking that tests, asks, connects and evaluates all aspects of a situation or problem. Critical thinking occurs when a problem arises in learning and prompts the following questions: "solve this problem another way", "ask a question...if", "what went wrong" and "what are you going to do". Critical thinking can also help improve a person's ability to deal with the problem at hand. Critical thinking is rational and reflective thinking that emphasizes making decisions about what to believe or do (Fisher, A. 2008; Lipman, M. 2003; Susanti, E., & Kusumah, Y. S. 2014; Subaini, S., et al., 2022).

Krulik, S., & Rudnick, J. A. (1996) found that critical thinking is also questioning thinking. Students will be able to ask if they know what they want to ask. Critical thinking is a direct and clear process for mental activities such as problem solving, decision making, persuasion, analyzing hypotheses, and conducting scientific research. Consistent with this, Paul, R., & Elder, L. (2019) argues that the aspects of critical thinking are focus, cause, conclusion, situation, clarity and overview. Through critical thinking, students become more curious because of the urge to be curious and the desire to know the truth. Habits of critical thinking will improve students' math skills. Students are encouraged to participate in various activities such as: facing different challenges in learning, discovering new things and solving unconventional problems (Van de Walle, J. A., et al., 2016; Soemarmo, U. 2013; Nababan, R. 2021).

Through critical thinking, students can understand problems well, develop plans to solve them, and come up with alternative solutions to problems in a more practical way. Therefore, students with critical thinking skills are expected to solve mathematical problems that require high-quality solutions (Ferrini-Mundy, J. 2000). Based on the above statements, it can be concluded that critical thinking enables and trains a person to learn mathematics (do math). This shows that students are no longer learning by memorizing, but learning mathematics by doing. Therefore, developing critical thinking skills is very important. It can be emphasized that improving the learning process through the selection of appropriate and innovative learning models in the school mathematics curriculum is a necessary prerequisite to achieve this goal (Irvan, I., & Muslihuiddin, R. 2020).

Nevertheless, the fact that it is happening at YPK Private Junior High School today is students' ability to think critically about mathematics is still low. This is seen when students only accept the information provided and do not question what is conveyed by the teacher, take notes without understanding what is written, so that if given a different problem they have difficulty, lazy to find sources of reading that support the material they are learning, rarely respond to questions raised by teachers. If given questions that require analysis, synthesis, and evaluation, students experience difficulties. The success of students can be influenced, one of which is the success of their learning (Hidayat, 2000, 2022).

Based on the above problems, the problem must be resolved so that the expected goal can be achieved, namely improving students' critical thinking skills, so constructive-based learning is needed. One of them is by applying Autograph-assisted Creative Problem Solving (CPS) models. The CPS model is a learning model that focuses on teaching and problem-solving skills, followed by enhancing creativity. When questions arise, students can use problem-solving skills to select and develop their responses. Not just by memorizing without thinking, but by extending the thought process to problem-solving skills. Emotional skills embodied in creative thinking include experiencing problems and opportunities, tolerating uncertainty, understanding the environment and creativity of others, openness, courage, risk-taking, self-control, curiosity, expressing and responding to feelings and emotions, and anticipating the unpredictable. While the metacognitive skills creative thinking include strategizing, setting goals and making decisions, making predictions based on incomplete data, understanding creativity and what others don't understand, diagnosing incomplete information, making multiple judgments, controlling Emotions and developing problem solutions and plan (Sister, D., et al., 2020; Triana, R., et al., 2021).

The CPS model is also a dynamic approach; students become more skilled because they have internal procedures that are more structured. By Using this learning model, it is hoped that it can generate interest as well as creativity and motivation of students in improving the ability of mathematical understanding and critical thinking so that students can get the maximum benefit both from the process and learning outcomes.

Learning mathematics with computer-assisted media is great, and when we support it with math software, it provides a lot of support for students when dealing with or analysing existing problems. One of the software you can use when learning mathematics is Autograph. Autograph is a piece of software or software that is very helpful during school learning; it was developed by Douglas Butter in 1984. The use of signatures in the classroom is an innovation in the learning of mathematics as we know it is traditional to learn mathematics in the classroom. Learning activities are often led by teachers, but students who use autographs are better able to develop learning methods. Signature Learning can accommodate slow learners. Most importantly, it ensures an effective climate, never forgets, never gets bored and stimulates a workout. Additionally, using autographs as a learning medium makes it easier for teachers to provide material, makes it easier for students to absorb what the teacher is communicating, and adds realism due to the availability of animated graphics, colors, and music.

RESEARCH METHOD

The experimental design in this study was a non-equivalent pre-test and post-test control group design. This study compares the treatment between creative problem-solving models with the help of autographs and without the help of autographs so that experimental research is the right choice. In it, there is testing and measurement of sample groups. The study population was all students of Medan YPK Private Middle School in class VII consisting of 4 parallel classes, and the selected sample was two classes. The instrument used was a critical thinking test in the form of a description.

RESULTS AND DISCUSSION

This study demonstrates differences in critical thinking skills between students who use the autograph-assisted CPS model and those who do not. The following is a summary of the completeness of critical thinking skills for students in Table 1.

Table 1. Recapitulation of Students' Critical Thinking Ability Completeness

No.	Aspect	Group	
		Experiment	Control
1.	The proportion of pretest scores	61,86	60,14
2.	The proportion of posttest scores	85,26	78,17
3.	Number of students who have completed	43	38
4.	% completed	95,6	90,5

As can be seen from Table 1, the average scores of the students in the control group were 60.14 and 78.17 in the pre-test and post-test respectively. If you look at the average post-test scores, the average score increases from 18.03. The average scores of the students in the experimental group were 61.86 and 85.26 in the pre-test and post-test, respectively, and the average ratio increased to 23.4. The proportion of pre- and post-test scores in the experimental group was greater than the difference in the proportion of pre- and post-test scores in the control group. This shows that learning by applying the CPS model using Autograph improves the performance of students' critical thinking skills more than learning by applying the CPS learning model alone.

Thus, classically, both the students in the experimental group and the students in the control group meet the integrity criterion, ie. H. 80% of students scored $\geq 70\%$ of the highest score. However, it has been verified that the completion rate of the students in the experimental class is higher than that of the students in the control class, with a difference of 5.1%. This means that the critical thinking ability of the students in the experimental class is better than that of the students in the control class when solving the material problem

of the equation system. Below is Table 2, which calculates the mean difference in critical thinking ability between the experimental and control groups.

Table 2. Test Results of the average difference in Critical Thinking Ability

Aspect	Experiment			Control			t_{test}	t_{table}	Ho
	\bar{X}_e	s_e	S_e^2	\bar{X}_k	s_k	S_k^2			
Critical thinking ability	51,16	3,66	13,38	46,90	4,52	20,47	4,85	1,6630	Ditolak

Based on the test results in Table 2 above obtained $t_{value} = 4.85 \geq t_{table} = 1.6630$, thus H_0 was rejected, or H_a accepted, so it was concluded that the critical thinking ability of students who obtained learning through the application of Autograph-assisted CPS models was better than students who obtained learning is only through the application of the CPS model. Based on the standard deviation values, it is obtained that there is a diversity of values in the two research groups; in other words, after learning is carried out, it turns out students' critical thinking skills become heterogeneous.

From the results of data analysis of student activities in the experimental group and the control group, it was found that the experimental group was more active than the control group. Student activities make students more creative. Based on student responses expressed through the attitude scale given to students, it was found that students' attitudes towards learning through the application of the CPS model using Autograph were positive. This can be seen from the attitude score, which is about 80% greater than the neutral attitude score, 72%. As an implementation, students can feel that learning activities through the CPS model by using Autograph affect their behavior when learning mathematics presented through learning. Furthermore, this means that the way students choose strategies in solving problems they face is certainly through ways that they can understand. Likewise, students can provide meaningful ways of planning a method or strategy for solving a problem or situation that is being faced and practicing describing the method or strategy they have on others.

Table 3. Student Activities During Learning Activities Through the Application of the Creative Problem Solving Model

No.	Aspects Observed	Average	
		Experiment	Control
1.	Hear/pay attention to teacher/friend's explanation and ability to respect others' opinions	80%	60%
	Read teaching materials and doing activity	100%	92%
2.	Ability to investigate	84%	64%
	Ability to plan as many problems so problem-solving	84%	68%
3.	Expressing opinions / ideas / asking	80%	76%
4.	Model the results / express an opinion	80%	68%
	The ability of students' creativity in contributing ideas	80%	76%
5.	Conduct discussions between students and students	96%	84%
	Hold discussions between students and teachers	88%	72%
6.	Noting things that are relevant to learning activities	100%	100%
	Make conclusions from learning outcomes	80%	64%
7.	Take individual quizzes	100%	84%

These results indicate that learning by using ICT or tolls that support will make students more happy and more creative in a learning process, so that the desired results can also be achieved. This happens because students are more helped in solving a problem that exists in learning, especially in making function graphs. Students in the experimental group no longer need to graph the function manually using a function graph table, but the students in the experimental class are able to complete it.

CONCLUSION

Based on the results of research and data analysis, it can be concluded that the critical thinking ability of students who obtained learning through the application of Autograph-assisted CPS models was better than students who obtained learning is only through the application of the CPS model. Based on the standard deviation values, it is obtained that there is a diversity of values in the two research groups; in other words, after learning is carried out, it turns out students' critical thinking skills become heterogeneous.

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