



Improving Students Critical Thinking Ability by Applying Science, Technology, Engineering, Art, Mathematics (STEAM) Learning Approach in Elementary School

Sri Defy Rahmawati¹

^{1,2,3,4,5}(University Pahlawan Tuanku Tambusai)

* Corresponding Author. E-mail: sridefyrahmawati@gmail.com

Receive: 17/07/2023

Accepted: 15/09/2023

Published: 01/10/2023

Abstract

The purpose of this study was to improve the critical thinking skills of class V students of UPT SDN 003 Batubelah in the 2022/2023 school year. This research was conducted in two cycles, each with two meetings and four learning stages: planning, implementation, observation, and reflection using the Classroom Action Research method. The research was conducted in May 2023. Documentation, observation, and test were the data collection techniques. The results showed that the critical thinking skills of grade V students had improved in cycle I meeting 1 with an average score of 67.42 and in cycle I meeting 2 with an average score of 69.76. The 1st meeting of cycle I showed an increase with an average score of 81.09, and the 2nd meeting showed an increase with an average score of 81.66. Thus, the critical thinking skills of UPT class V students of SD Negeri 003 Batubelah can be improved by applying the STEAM learning approach.

Keywords: Approach to Learning Science, Technology, Engineering, Art and Mathematics (STEAM), Critical Thinking

Introduction

The growing era of globalization, as well as advances in science and technology and increasingly modern, has an impact on all areas of life. Education is a guideline to face the 21st century, science and technology must be prepared (Agnafia, D, 2019). Students who think critically, creatively, independently, collaboration, creativity, information, communication and learning independence are competencies needed to face global competition in the 21st century. Students in preparing for the changing times that are increasingly modern and developing the ability to think critically is needed.

The ability to think critically is very important, but the reality we see does not meet expectations, because the learning process in elementary schools does not focus on improving

students' critical thinking skills, as expected from the design, implementation, and learning procedures (Dores, O et al., 2020). Critical thinking skills are essential in the 21st century to deal with the rapid flow of change. This way of thinking about concepts or ideas related to the problem at hand is known as critical thinking. Analyzing, distinguishing, selecting, identifying, reviewing, and developing concepts more fully is one form of critical thinking (Subahan et al., 2022). Updating the quality of learning in the classroom can help improve students' critical thinking skills. Teachers should not only give theories to students but must involve students. Students have the opportunity to engage in the learning process and find solutions to problems with the STEAM approach.

STEAM is the development of STEM education by adding art elements to its learning activities. Problem solving, collaboration, project-based learning, self-directed learning, and challenge-based learning are some of the thinking skills that STEAM encourages students to research and learn (Mu'minah, I & Suryaningsih, 2020). The STEAM approach encourages students to explore all their abilities individually. Each individual or group using STEAM will produce unique and unexpected work. In addition, since this method is used in groups, communication, collaboration and cooperation will emerge in the learning process. Organizing students in STEAM groups helps students understand the lesson by providing individual and interpersonal responsibility. Students will actively strive to create their own learning strategies. Critical thinking, problem solving and collaboration are the skills expected from students through this STEAM approach (Hadinugrahaningsih et al., 2017).

Researchers found problems during observations and interviews on March 09, 2023 conducted in class V UPT SDN 003 Batubelah as for the problems in class V, more precisely in the learning process, (1) students' critical thinking skills are still lacking, (2) students want to finish quickly when working on problems without thinking about the answers made. Therefore students are less critical and teleti in answering questions. (3) Students tend to look at the answers of their friends without caring whether the answers made by their friends are correct or not, (4) Students only listen to the material because learning is teacher-centered (5) teachers do not use approaches or learning models due to cost and time. Based on the observations of researchers in class V UPT SDN 003 Batubelah, it seems that students' ability to think critically is still low and when researchers conduct pre-action test questions to class V students. The test given to see students' critical thinking skills is an essay test.

The results of interviews conducted by researchers on March 09, 2023 with Mrs. Irene Susanti S.Pd.I as the fifth grade teacher of UPT SDN 003 Batubelah in the learning process, students have low critical thinking skills,

students in concluding learning are still lacking, in answering questions less thorough and only quickly finished. STEAM-based learning is still rarely applied in schools due to the lack of training on the introduction of STEAM learning to elementary school teachers. Teachers should use learning approaches or models in the teaching and learning process, so that students do not feel bored and enthusiastic about learning. Students can be encouraged to be active in learning. In an effort to improve the quality of learning, teachers play a role in terms of classroom management and teachers must create a pleasant learning atmosphere. Based on that problem, to improve students' critical thinking skills, it is necessary to improve the learning process. It can be seen from the test that students do not meet the standard of critical thinking ability, which is 70. Therefore, the teacher uses a learning approach in order to improve the scores of students who have not yet reached the criteria for critical thinking ability. This can be seen from the students' recapitulation scores in the following table:

Table 1. Percentage of Students' Grades Pre-action

No	Number of Students	Category	Percentage (%)
1	1 Student	Critical	04,76 %
2	4 Students	Moderately critical	19,04 %
3	16 students	Not very critical	76,19 %

(Source researcher 2023)

The results of the pre-action student scores above, became the basis for the researcher's idea that the ability of grade V students to think critically UPT SD Negeri 003 Batubelah was low in answering questions and needed to be improved. The solution to improve students' ability to think critically is to apply the STEAM learning approach, which is interesting in that learning will bring students directly to foster students to think critically.

Methods

The method used by researchers is class action research or commonly called PTK. Classroom action research is research conducted to improve problems or learning processes in the classroom. PTK is an action research conducted by teachers in the classroom by

designing, implementing and reflecting on actions in a collaborative and participatory manner. The aim is to improve and improve the quality of the learning process through a certain action in a cycle Kunandar in (Mulia & Suwarno, 2016).

Research Subjects

The subjects of this study were all fifth grade students of UPT SDN 003 Batubelah, out of a total of 21 people, there were 13 female and 8 male students.

Time and Place of Research

The research was conducted at UPT SD Negeri 003 Batubelah, Kampar District. The reason researchers chose UPT SD Negeri 003 Batubelah as a research site, because based on the results of field observations and pre-action tests, problems were found related to the indicators of students' critical thinking which were still lacking. The research time was conducted in May even semester of the 2023 school year.

Research Procedure

Cycle I and Cycle II carry out classroom action research procedures, each cycle has two meetings. Each PTK cycle consists of four stages, namely planning, implementation, observation, and reflection.

Figure 1. PTK Procedure (Suharsimi Arikunto, 2014)

Data Collection Techniques

This research uses observation sheets to collect data about the learning process and teacher and student activities during learning, documentation is in the form of documents both image documents, and written documents. The test technique assesses students' critical thinking skills.

Research Instruments

Researchers used observation sheets to observe the process and tests to determine the results of the study.

Data Analysis Technique

Data analysis is the process of systematically searching and compiling data that has been obtained. The purpose of this process is to find solutions to the research problems that have been formulated. This research uses qualitative and quantitative data analysis techniques. The criteria for critical thinking skills are as follows:

Table 2. Critical Thinking Ability Criteria

Indicator Mastery Level	Description
90 – 100	Very Critical
80 – 89	Critical
70 – 79	Moderately Critical
<69	Very Not Critical

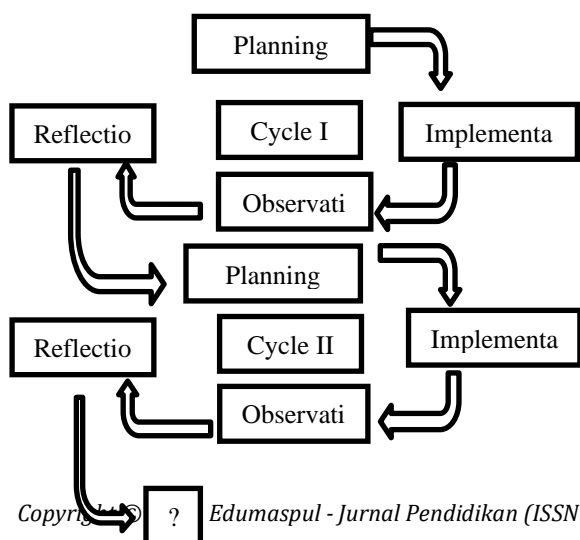
Source : Wowo in (Gusliani Ema, 2021)

Results and Discussion

Cycle I Results

The results of the assessment of critical thinking skills using STEAM in the learning process of grade V students can be seen from the results that have been carried out in cycle I and evaluated by researchers as practicing teachers who are authorized by the homeroom teacher. Table 3 shows the results of students' critical thinking skills in cycle I meetings I and II:

Table 3. Critical Thinking Score of Grade V using STEAM Approach



Score	Category	Meeting I		Meeting II	
		T	TT	T	TT
90-100	Very Critical	-	-	-	-
80-89	Critical	4	-	7	-
70-79	Moderately Critical	3	-	3	-
<69	Not very critical	-	14	-	11
Total		7	14	10	11

(Researcher source)

Cycle I meeting I of the 21 students, table 3 above shows that 7 of them reached the 70 category in critical thinking ability, while the other 14 did not reach the set category. In the second meeting, out of a total of 21 students, 10 of them reached the critical thinking ability category, and the other 11 did not reach the category set by the researcher. Applying the STEAM learning approach in class V there is an increase in critical thinking skills. Cycle I is still considered not critical, with an average of 67,42. Cycle I meeting II increased to 69,76.

Cycle II Results

The following recapitulation table shows the results of observations of critical thinking skills of UPT SD Negeri 003 Batubelah students in cycle II meetings I and II. These results show the results of learning critical thinking skills in class V with the STEAM learning approach:

Table 4. Critical Thinking Ability Score of Grade V Students using STEAM Learning Approach

Score	Category	Meeting I		Meeting II	
		T	TT	T	TT
90 – 100	Very Critical	4	-	4	-
80 – 89	Critical	11	-	9	-
70 – 79	Moderately Critical	1	-	5	-
<69	Not very critical	-	5	-	3
Total		16	5	18	3

(Researcher source)

In cycle II meeting I, out of 21 students, 16 achieved the critical thinking ability category with a minimum score of 70 determined by the researcher, as shown in table 4. In addition, 18 out of 21 students in the second meeting reached the critical thinking ability category with a minimum score of 70. A total of three

students were in the very uncritical category, which means they did not reach the critical thinking ability category. The critical thinking ability scores of grade V students of UPT SD Negeri 003 Batubelah in the second cycle action increased compared to the first cycle scores using the STEAM learning approach. In the second cycle, students' critical thinking skills increased with an average of 81.66 and were categorized as critical. Thus, the results of their critical thinking skills are categorized as critical.

Discussion Cycle I

Learning Theme Meeting 8 in Class V UPT SD Negeri 003 Batubelah. Researchers must make lesson plans because the learning process must be planned. The role of this research investigator is to make research instruments including learning syllabus, lesson plans based on STEAM learning approach, and observation sheets and observation sheets for student and teacher activities Mrs. Irene Susanti, S.Pd.I., asked colleagues to be observers.

Identity, core competencies (KI), basic competencies (KD), indicators, learning objectives, subject matter, learning steps (initial, core, and final activities), subject matter, and evaluation are important components of lesson plans. It is said that the STEAM learning approach, which includes planning and implementing classroom learning, has the ability to improve students' critical thinking skills. When students' critical thinking ability objectives were not adequately implemented in the second cycle, better planning was required. After using the STEAM learning strategy and being observed by the researchers during Cycle I, the researchers created lesson plans in Cycle II to achieve the markers of students' critical thinking skills.

The teacher stimulates students based on the topic material before the action and after entering the classroom, so that students can easily understand it. Researchers also review the strengths and weaknesses that occur in the classroom, so that teachers can prepare themselves to guide students in using the STEAM learning approach if they teach well in Cycle II actions, because the STEAM learning

approach has shortcomings that must be considered. reflected in its implementation in Cycle II.

This finding shows that careful planning is very important to develop critical thinking skills. This planning is done thoroughly, starting from designing syllabus and lesson plans, self-preparation, making observation sheets of teacher and student activities, making STEAM learning methods, and making critical thinking assessment sheets and evaluation questions.

Cycle I learning results were still less than optimal because students were not used to the learning approach used by the teacher. The teacher began by showing a learning video so that students were very interested in seeing the learning video. The shortcoming in cycle 1 meeting 1 is that the teacher did not present a video example of making a water cycle project, so students lack imagination and have difficulty in creativity. Students were not confident to voice their opinions when the teacher tried to provoke them with questions that could be explored and increase their knowledge. When learning takes place, there are some students who learn to still play, telling stories with their friends. The implementation at meeting 2 has improved from presenting the project video, in managing the class there has been progress, guiding students needs to be improved again in learning. The teacher's learning process and the process of guiding students are very important. This can happen when teachers do not familiarize students to speak publicly. Therefore, when students did cycle I, they were considered to have less critical thinking skills, so they were moved to cycle II.

Learning in the second cycle has gone better because students have been able to do learning according to the steps listed in the lesson plan and are used to it. Implementation based on the teacher activity sheet notes in cycle one, the first and second meetings have improved in terms of learning implementation and classroom management and the results of students' critical thinking skills have also improved. Notes on student activity sheets for cycle 2, meetings 1 and 2, there was an increase and seriousness of students in the learning process. Many students have realized the

indicators of critical thinking skills during the learning process. Of the four indicators used, the highest student score was given to the first indicator, which includes a simple explanation, while the lowest student score was given to the indicator that includes building basic skills. The results of the implementation of cycles I and II show that the STEAM learning approach can improve the critical thinking skills of grade V students of UPT SD Negeri 003 Batubelah.

The results of research with the STEAM learning approach show that activities have advantages and disadvantages during the learning process. This is influenced by classroom conditions when learning takes place and how the teacher manages the class. The researcher's way to improve student learning outcomes by motivating and rewarding students who achieve the best level, with other students inspired and serious in learning. In the first meeting of cycle I, students' critical thinking skills were improved with the STEAM learning approach. Most of the 21 students met the criteria for critical thinking skills, with 7 of them receiving a minimum score of 70 with an average of 67.42. Those who got the critical category were 4 students with the initials AYU, FF, H, KS, those who got the moderately critical category were 3 students with the initials AIR, NZ, RH while the second meeting of cycle I reached the category determined by the researcher as many as 10 students with an average of 69.76 students who got the critical category were 8 students with the initials AN, AYU, AIR, FF, KS, RH and RW and students in the moderately critical category were AFZ, MA and NZ. In the first cycle of action, there were no students who reached the very critical category. However, at meeting II, the value of critical thinking skills of class V students of UPT SD Negeri 003 Batubelah increased to 69.76. This value increases using the STEAM learning approach.

Cycle II meeting I showed an increase in critical thinking skills for 21 students, 16 of whom reached the category with an average of 81.09, students who reached the very critical category were 2 with the initials AN, AYU, who got the critical category there were 11 with the initials AFZ, AIR, FAF, H, KS, MA, NZ, RW,

SNA, ZDP, ZAQ, In Cycle II, 18 students experienced an increase again, with an average of 81.66 at the second meeting, who got a very critical category with the initials AN, AYU, AIR FF, who got a critical category there were 10 with the initials AFZ, FAF, KS, MA, MRA, NZ, RH, RW, RHL SNA, the sufficient category was 4 people with the initials FH, H, ZDP and ZAQ. There are 3 students who are not critical with the initials ASS, MFA, and ZA due to learning difficulties. The learning difficulties of these students are the slowness of students in understanding the material, the lack of students' attention in learning, when they continue to play, talk, daydream, and disturb their friends during the learning process. The value of critical thinking skills of grade V UPT students of SD Negeri 003 Batubelah in cycle II action increased compared to the value in cycle I action using the STEAM learning approach. Students' critical thinking skills increased in cycle I with an average of 67.42 and in cycle II with an average of 81.66. Figure 1 shows the increase in students' critical thinking skills resulting from the application of the STEAM approach.

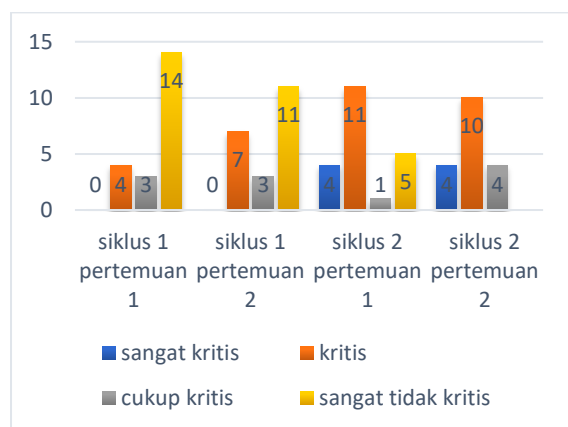


Figure 1: STEAM Learning Approach Improves Students' Critical Thinking Skills

Conclusion

The results of two cycles of research show that the Science, Technology, Engineering, Arts, and Mathematics (STEAM) learning approach can improve students' critical thinking skills in class V UPT SD Negeri 003 Batubelah in the 2022/2023 school year. The conclusion is that this approach can improve students' critical

thinking skills in class V UPT SD Negeri 003 Batubelah. The results showed that in cycle 1 meeting I, 7 students with an average of 67.42 reached the critical thinking ability category with a minimum score of 70, in cycle 1 meeting II, 10 students with an average of 69.76 reached the critical thinking ability category with a minimum score of 70. The results showed that 16 students in cycle II meeting I reached the critical thinking ability category with a minimum score of 70. While 18 students in cycle II meeting II reached an average score of 81.66.

Bibliography

- [1] Agnafia, D, N. (2019). Analysis of Students' Critical Thinking Skills in Biology Learning. *Florea: Journal of Biology and its Learning*, 6(1), 45–53.
- [2] Agry, F, P., & Kartono. (2021). Implementation for the STEAM Model (Science, Mathematics Learning for Elementary School Teacher Education Students. *Proceedings of the National Postgraduate Seminar of Semarang State University*, 126–129.
- [3] Aini, N., Surya, Yenni., F., & Pebriana, Putri., H. (2020). Improving critical thinking skills using the Problem Based Learning (PBL) model in grade IV students of MI Al-Falah. *Journal of Education and Counseling*, 2(2), 179–182.
- [4] Dores, O, J., Wibowo. D, C., & Susanti, S. (2020). Analysis of Students' Critical Thinking Skills in Mathematics Subjects. *Journal of Innovative Mathematics Learning*, 2(2), 242–254.
- [5] Gusliani, E. (2021). *Efforts to improve students' critical thinking skills by using the Problem Based Learning (PBL) model in elementary school students*. Pahlawan Tuanku Tambusai University.
- [6] Hadinugrahaningsih, T., Rahmawati, Y., Ridwan, A., Budiningsih, A., Suryani, E., Nurlitiani, A., & Fatimah, C. (2017). *21st Century Skills and STEAM (Science, Techonology, Engineering, Art, and athematics) Project in Chemistry Learning*.

- [7] Masrinah, E, N., Aripin, I., & Gaffar, A, A. (2019). Problem Based Learning (PBL) to Improve Critical Thinking Skills. *National Seminar on Education*, 924–932.
- [8] Maulana, I. (2022). *Science, Technology, Engineering, Art and Mathematics (STEAM) Approach to Students' Creative Thinking Ability: A Meta-Analysis Study*.
- [9] Mulyani. (2020). *Improving Critical Thinking Skills by Using Problem Based Learning Models*.
- [10] Oktaviani, V, A., Lyesmaya, D., & Maula, L, H. (2020). Improve understanding of mathematical concepts using an online-based STEAM approach. *JKPD Journal of Basic Education Studies*, 5(2), 139–149.
- [11] Rahmawati, B, A. (2020). *Implementation of STEAM-Based Learning in Fostering Critical Thinking Skills at SD My Little Island Malang*.
- [12] Sa'ida, N. (2021). Implementation of the STEAM Learning Model in Online Learning. *Journal of Basic Education Review: Journal of Education Studies and Learning Outcomes*, 7(2), 123–128.
- [13] Shabrina, S, Z., & Sholihah, H. (2022). Analysis of the Application of STEAM Learning in Elementary Schools. *EduCurio*, 1(1), 209–216.
- [14] Subahan, A., Fadhillaturrahmi, & Aprinawati, I. (2022). Improving Students' Critical Thinking Skills Using the Learning Start with A Question (LSQ) Model in Elementary Schools. *Edumaspul: Journal of Education*, 6(1), 1344–1351.
- [15] Sumaya, A., Israwaty, I., & Ilmi, N. (2021). Application of STEM Approach to Improve Learning Outcomes of Primary School Students in Pinrang District. *Pinisi: Journal Of Education*, 1(2), 217–223.
- [16] Zubaidah, S. (2019). STEAM (Science, Technology, Engineering, Arts, and Mathematics): Learning to Empower 21st Century Skills. *National Seminar on Mathematics and Science, September*, 1–18.
- [17] Adella, B., Fadhillaturrahmi, & Marta, R. (2022). Improving students' critical thinking skills using the Creatif Problem Solving (CPS) model in elementary school. *Journal of PGMI Study Program*, 9(4), 149–158.

Author Profile

Sri Defy Rahmawati is the name of the author of this article. The author was born in Bangkinang, April 28, 2001 to Father Mhd. Kamil and Mrs. Elfianti. The author is the 3rd child of 4 siblings. The author is studying at Pahlawan University with a major in Elementary School Teacher Education until 2023.