

Implementation of Student Worksheet Oriented to Critical Thinking Skills on Heat Transfer Material

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Abstract. This research was initiated by the absence of students critical thinking skills in science learning which can be seen in filling out the Student Worksheet when doing practical activities. This study aimed to determine: 1) the implementation of POE-based Student Worksheet and 2) the results of POE-based Student Worksheet implementation in generating critical thinking skills for fifth grade students of Public Elementary School of Girimukti, Cijambe District, Subang Regency on heat transfer material. This research used descriptive qualitative method. The instruments used were observation sheets and test questions. Data were collected by filling out observation sheets and test questions. The data were analyzed by using qualitative descriptive, namely through scoring, percentage, interpretation, and a description of each aspect. The results of this study were namely: 1) The implementation of POE-based Student Worksheet in practical activities is in the "good" category and 2) The results of POE-based Student Worksheet implementation in filling out LKPD and test results are in the "Good" category. Thus, researchers can conclude that the implementation of POE-based Student Worksheet can boost students' critical thinking skills.

Keywords: Student Worksheet, POE, Critical Thinking Skills, Students, Heat Transfer.

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INTRODUCTION ~ In an attempt to improve student learning outcomes, teachers are required to be able to manage the learning process that provides a stimulus to students so that they are motivated to learn, because students are the main subjects of learning. As Moh. Uzer Usman (2006, p. 21) argued that there are at least five types of variables that determine the success of student learning in order to make effective teaching and learning conditions, including: (1) Involving students actively; (2) Attracting the interest and attention of students; (3) Generating student motivation; (4) the principle of individuality; and (5) Demonstration in teaching.

Based on the analysis results, it can be seen that one of the causes for the

emergence of critical thinking skills in students in learning activities is the use of student worksheet (LKPD) which have not provided a stimulus to the emergence of critical thinking skills. The absence of these critical thinking skill indicators is a problem that needs to be addressed immediately because critical thinking skills have strategic value in life (Saputri et al., 2019). Student Worksheet that is currently used in science learning activities is that has been listed in the 2013 curriculum student book containing only short questions that do not require critical thinking. Therefore, students only provide short answers without being accompanied by arguments related to the results of the practicum. These questions can only be answered through scientific activities carried out by experts, starting

from observation, data collection, data analysis, hypothesis submission, hypothesis testing, interpretation, and conclusions (cited in Atep Sujana, et al. 2014). In the learning process in elementary schools, teachers most often interact with students, so the role of the teacher tremendously determines student learning outcomes. Teachers are also not only obliged to instill concepts and processes in learning, but also to instill attitudes to their students that cannot be given by any media. The teachers very vital role makes them as one of the most important components in determining the success of the learning. Sagala (2008: 6) suggested that "teachers are tasked with planning and implementing the learning process, assessing learning outcomes, conducting guidance and training, conducting research and assessment, and opening communication with the community."

Chappell and Craft (cited in Utami et al., 2017) stated that student worksheets are part of teaching materials that can be used to develop thinking skills, ask and answer questions, make connections, and assess the development of student learning outcomes. Then, Arief (2015) claimed that "Student Worksheet is one of the means to help and facilitate learning activities so that effective interactions will form between students and teachers, and can increase student activities in improving learning achievement. It usually contains the title of the Student Worksheet, basic competencies, completion time, materials/equipment used, brief information, work steps, tasks to be done, and reports to be done. Hence, it is still tremendously much needed to support more effective learning for some lessons that require understanding

through practice questions, such as in science lesson. In addition, Student Worksheet is needed to teach the nature of science in schools, especially elementary schools. Meaning that, it requires a certain learning approach which is presented explicitly and contextually. Learning about the nature of science is highly important for both teachers and students (Adi, et al. 2018).

Regarding with this, Student Worksheet should be used as a learning tool that can be used in exploring the activeness and critical thinking skills of students. Student Worksheet designed by the teacher will be more effective for use in learning, because it is adapted to the characteristics and needs of the students concerned. In addition, teachers can integrate indicators of critical thinking skills in learning so that students become more trained. One of the solution that can be done is by implementing a POE-based Student Worksheet (Predict, Observe, Explain). POE provides a series of methods that are essential to attract students to understand the importance of science concepts. The POE learning strategy is a strategy in learning that was initiated by White and Gustone (1992, p. 58) aiming to reveal the ability of students to make predictions individually.

The activities carried out by students based on the POE stages according to Nugraha et al., (2019) are as follows: 1) Predict stage, namely writing predictions in the form of answers or pre-learning questions related to the experiments to be carried out; 2) Observe stage, which is to make observations to test predictions; 3) Explain stage, which is to provide an explanation of the predictions that have been made related to the findings.

Ennis (1993) also stated the same thing that the types of thinking processes in Bloom's Taxonomy are related to each other but not hierarchical. He gave an example that evaluation and synthesis do require an analyst, but on the other hand, analysis also requires evaluation and synthesis. Types of thinking can be grouped based on the processes that occur in the brain. Critical thinking, creative thinking, system thinking, and other types of thinking describe different processes in the brain.

The indicators of Critical Thinking Skills according to Ennis (in Ari Widodo, 2021) include: 1) Looking for clear statements from questions; 2) Looking for excuses; 3) Trying to know the information completely; 4) Using credible sources and citing them; 5) Paying attention on the overall situation and condition; 6) Trying to stay relevant to the main idea; 7) Bearing in mind the original and fundamental interests; 8) Looking for alternatives; 9) Being open and think; 10) Taking a position when there is sufficient evidence to do something; 11) Seeking as many explanations as possible; and 12) Being systematic and orderly with part of the whole problem.

Based on the reasons and considerations related to the selection of the POE strategy as the basis for implementing Student Worksheet and the importance of teaching the nature of science to think critically in the learning activities that have been stated above, the researcher can conclude that the point is that POE was chosen because the stages of activities are systematic, practical, and simple to improve critical thinking skills applied in learning, especially during the Covid-19 pandemic, where learning can only be carried out face-to-face.

Researchers implement POE-based Student Worksheet to improve critical thinking skills designed in the heat transfer material science practicum.

METHOD

Research Design

Based on the research problems, the research design used is research by producing a product in the form of a POE-based student worksheet (LKPD).

Method

The method used in this study is a qualitative method with a descriptive approach.

Research Subjects

The subjects of this study were fifth grade students of Girimukti Public Elementary School, Subang Regency for the 2020/2021 academic year, totaling 25 students consisting of 14 male students and 11 female students.

Data Analysis

The critical thinking skills test was carried out after the POE-based Student Worksheet was implemented. The tests given were in the form of descriptive questions related to practical material and were adjusted to the indicators of critical thinking skills that are willing to be revealed. The analysis technique used was descriptive qualitative with the following calculations:

$$\% \text{ score} = \frac{n}{5 \times N} \times 100\%$$

Student success rate =

Remarks:

n = total score obtained

N = number of indicators

RESULT

Based on the research that has been carried out, the results of observations and research results in the implementation of student worksheets (LKPD) oriented to critical thinking skills are as follows: (1) a POE-based Student Worksheet in science learning for grade V of Elementary School on heat transfer material; (2) the results of observations on the implementation of POE-based Student Worksheet; (3) the results of observations on the emergence of students critical thinking skills in filling out the POE-based Student Worksheet, and (4) students test results. The following will explain the findings more

clearly based on the results of research that has been conducted.

The student worksheet is presented very simply, with a few short questions that do not require high-level thinking and arguments from students. The student worksheet practicum "Experiment of Cooking Pans from Paper" consists of three parts, namely tools and materials, practicum steps, and questions.

The following are the results of observations on the implementation of the POE-based Student Worksheet obtained from filling out the Student Worksheet by student.

Table 1. Results of Observation of POE-Based Student Worksheet Implementation

No	Activities of Student Worksheet Implementation	Implementation in Learning	
		Yes	No
1.	Students use Student Worksheet as a guide for carrying out practicum	√	-
2.	Students fill out activity 1 on Student Worksheet	√	-
3.	Students fill out activity 2 on Student Worksheet	√	-
4.	Students fill out activity 3 on Student Worksheet	√	-
5.	Students fill in the Student Worksheet each part that must be filled in Student Worksheet	-	√
6.	Students fill in the Student Worksheet with coherent sentences	-	√
7.	Students answer all questions on the Student Worksheet completely and correctly	-	√
8.	Students fill in the Student Worksheet with neat and legible writing	√	-
Total		5	3
Percentage		62,5%	37,5%
Category		Good	

Based on the research activities that have been done, the following will describe the results of the POE-Based Student Worksheet implementation in Raising Students' Critical Thinking Skills on Heat Transfer Material. The results of this implementation include two aspects,

namely the results of filling out the Student Worksheet and the results of the description of students critical thinking skills. In table 2, it is described in detail the percentage of occurrence of each indicator of critical thinking skills in the Student Worksheet

Table 2. Summary of Students Critical Thinking Skills Test Results

POE Stages	Critical Thinking Aspects	Critical Thinking Indicators	Occurrence	Percentage	Mean	Category
1. Predict (Prediction)	Providing a simple explanation	a. Identifying/formulating questions	18 students	72%	78%	Good
		b. Answering questions	21 students	84%		
2. Observe (Observation)	Building basic skills	a. Designing procedures or practical steps	17 students	68%	74%	Good
		b. Recording the observation results of the practicum carried out	20 students	80%		
3. Explain (Explanation)	Providing further explanation	a. Defining a term related to practical material	14 students	56%	58%	Enough
		b. Making arguments based on practical results	15 students	60%		
	Setting strategy and tactics	a. Using logical arguments in explaining practical results	16 students	64%	60%	Enough
		b. Looking for alternative solutions related to the practicum carried out	14 students	56%		
3. Conclusion	Concluding the practicum	a. Making an interpretation	17 students	68%	78%	Good
		b. Making a conclusion from the results of the practicum.	22 students	88%		
Total			174	696%	348%	Good
Mean			70	70%	70%	

Based on the analysis results of filling out the POE-based Student Worksheet, the indicators of critical thinking skills in the Student Worksheet as a whole appear in students with various variations. However, from the percentage of

occurrences, it can be seen that not all indicators of critical thinking skills are in good categories.

In summary, the percentage of the appearance of indicators of critical

thinking skills in these students can be illustrated in Diagram 1 below:

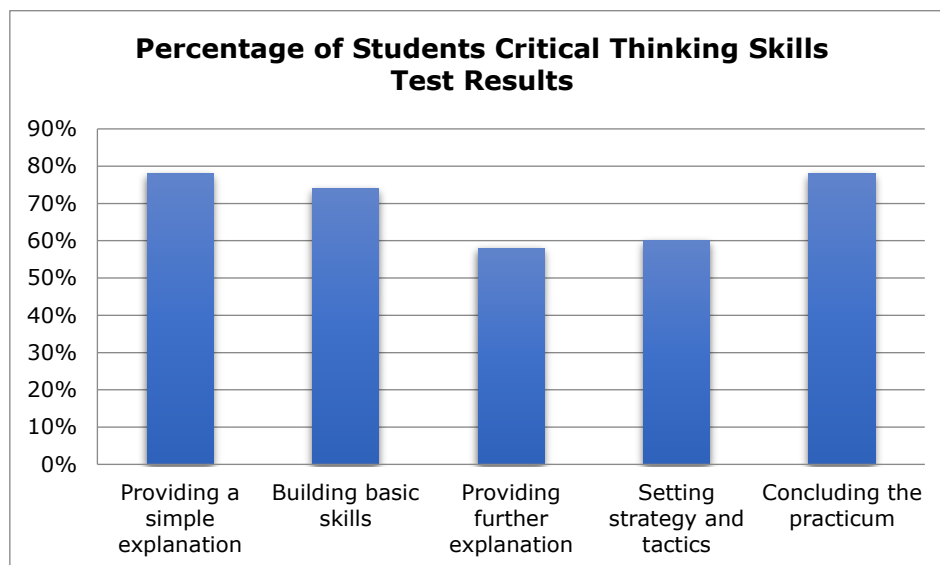


Figure 1. Percentage Diagram of Students Critical Thinking Skills Test Results

DISCUSSION

Based on the results of the analysis of filling out the POE-based Student Worksheet, the indicators of critical thinking skills in the Student Worksheet as a whole appear in students with several variations. However, from the percentage of occurrence, it can be seen that not all indicators of critical thinking skills appear in good category.

The emergence of students critical thinking skills after the implementation of the POE-based Student Worksheet is also strengthened through written test results which contain indicators of critical thinking skills that will be revealed. The test questions given to students were in the form of description questions totaling 10 numbers according to the critical thinking skills indicators that is willing to be revealed.

Based on the POE-Based Student Worksheet Implementation Observation, the results showed that the level of

Student Worksheet implementation activities in learning was 62.5% or 5 aspects of emergence related to the involvement of students in each stage of activity, such as students using Student Worksheet as a guide to carry out practicum, filling out activity 1, filling out activity 2, and filling out activity 3, while the level of implementation in learning that has not appeared optimally, which was 37.5% or 3 aspects, especially in terms of completeness of all questions, such as filling in completely each part that must be filled in on the out, answering all questions on the out completely and correctly, and fill out the out in neat and legible writing.

Based on the Students Critical Thinking Skills Test, the results show that at the predict (prediction) stage, the critical thinking aspect provides a simple explanation with the sub-indicator identifying/formulating questions, there were 18 students with a percentage of 72% and the sub-indicator answers questions as many as 21 students with a

percentage of 21% so the average obtained is 78% and is included in the "Good" category. Furthermore, at the observe (observation) stage, the critical thinking aspect of building basic skills with the sub-indicator designing procedures or practicum steps, there were 12 students with a percentage of 68% and the sub-indicator records the results of observations of the practicum carried out by 20 students with a percentage of 80% so that the average obtained is 74% and is included in the "Good" category. Then, at the explain stage, the critical thinking aspect provides further explanation with the sub-indicator defining a term related to the practicum material, there were 14 students with a percentage of 56% and the sub-indicator makes an argument based on the results of the practicum 15 students with a percentage of 60% so that the average obtained is 58% and is included in the "Enough" category. Then, in the aspect of setting strategies and tactics with sub-indicators using logical arguments in explaining the results of the practicum, there were 16 students with a percentage of 64% and the sub-indicator looking for alternative solutions related to the practicum carried out, there were 14 students with a percentage of 56% so that the average obtained is 60% and is included in the "Enough" category. Until the conclusion stage, the critical thinking aspect concludes the practicum with the sub-indicator making an interpretation, there were 17 students with a percentage of 68%, and the sub-indicator makes a conclusion from the results of the practicum as many as 22 students with a percentage of 88%, so that an average of 78% is obtained and is included in the "Good" category.

The final result shows the emergence of students critical thinking skills with an average number for each indicator and sub-indicator of critical thinking aspects of 70% which is included in the "Good" category.

This Student Worksheet design was made referring to the stages of the POE (Predict, Observe, Explain) learning strategy. Therefore, the contents of this Student Worksheet broadly consist of three stages of activity, namely predicting, observing, and explaining which includes indicators of critical thinking skills that is willing to be revealed. At the predict stage, students are asked to predict what will happen after the practicum. Then, at the Observe stage, in this Student Worksheet, students are guided to make observations during the practicum. Furthermore, at the explain stage, students are asked to fully explain the results of the practicum that has been done. In closing the activities in the Student Worksheet, there is a conclusion stage. In this section, students are asked to conclude the results of the practicum that has been carried out.

CONCLUSION

Based on the research data, findings, and discussions that have been presented, researchers can make conclusions regarding the development of Student Worksheet in developing students critical thinking skills as follows:

1. The POE-based Student Worksheet design in developing students critical thinking skills is made in accordance with the stages of the POE learning strategy, namely predict (prediction), observe (observation), and explain (explanation). The POE-based Student Worksheet consists of

- three interrelated practicum activities on heat transfer material.
2. Implementation of POE-based Student Worksheet in raising students critical thinking skills on heat transfer material is broadly included in the "Good" category.
 3. The results of the POE-based Student Worksheet implementation test in raising students critical thinking skills on heat transfer material are broadly included in the "Good" category

Student Worksheet is one of the teaching materials that supports the learning process and the achievement of student learning outcomes. Teachers should be more creative in designing their own worksheets that will be used in learning according to the characteristics and learning needs of students to improve critical thinking skills.

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