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The Influence of Experiential Learning in Improving Students' Critical Thinking Skills on Motion and Force Material

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Abstract- Science learning is not enough to just be a product, but also a process and application in everyday life. Providing experience to students so that they are able to develop critical thinking skills through the application of the Experiential Learning model is a suitable solution to the facts in the field. This study aims to describe the level of critical thinking skills of students who apply the Experiential Learning model, and to determine the differences in the level of critical thinking skills of students between classes that apply the Experiential Learning model and classes that apply conventional learning models on the material of motion and force. This research was conducted in 2024/2025 in the odd semester. The population used was 200 students of class VII of SMPN 46 Pekanbaru. The sample was class VII B and class VII E, totaling 80 people. The research instrument was in the form of 6 descriptive questions arranged based on critical thinking indicators. The posttest of critical thinking skills was carried out after the learning of temperature and heat material was completed in both classes. The data from the posttest of critical thinking skills were then analyzed descriptively and inferentially. The results of data processing show that there is a difference in the average score of the experimental class, which is 80.82 (high category) and the control class, which is 72.49 (quite high category). Inferential analysis shows that there is a significant difference between the group that applies learning using the Experiential model and the group that uses the conventional learning model..

Keywords: *experiental learning, critical thinking, motion and force*

1 Introduction

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have spiritual religious strength, self-control, personality, intelligence, noble morals, and the skills needed by themselves, society, nation and state. (Depdikbud, 2014).

The learning process must certainly meet the teaching objectives so that it can meet the educational objectives properly. The teaching objectives are a description of the behavioral appearance (performance) and can build the life skills of students that are expected after studying certain learning materials. Life skills and abilities about the behavioral appearance (performance) of students can be trained through science learning. This is because science learning is carried out by students through scientific inquiry which can foster the ability to think, work and behave scientifically and communicate it as an important aspect in building life skills and behavioral appearance of students, especially in junior high school Physics Science learning where students can understand concepts, principles, laws, theories of physics, as well as their interrelationships and applications to solve problems in everyday life in the environment. (Mexi, 2020).

The Indonesian government realizes that to become a developed country and be on par with other developed nations, critical human resources are needed. Therefore, critical thinking skills are included in the national education goals. Critical thinking is an important skill for students, so critical thinking should

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be one of the activities that must be developed and taught in every subject, because critical thinking skills are not innate and do not develop naturally (Resky Hidayanti, 2019). However, what is happening now based on the survey data from TIMSS (The Trends in International Mathematics and Science Study) in 2011 shows that more than 95% of students in Indonesia are only able to answer questions at an intermediate level, while in Taiwan almost 50% of students are able to answer questions at a high level. Thus, it can be seen that the level of critical thinking skills of students in Indonesia is still low. Based on the results of interviews with the curriculum representative of SMPN 46 Pekanbaru and Mrs. Mutia Apri Yeni as a science teacher at SMPN 46 Pekanbaru, it was found that students' critical thinking skills are still relatively low because students are still not used to answering questions in the form of critical thinking. This is evidenced by the results of students' daily tests in the chapter on temperature and heat delivered by Mrs.

Mutia as a science teacher about the learning outcomes of grade VII students, around 50% of whom did not complete the KKM. The Minimum Completion Criteria (KKM) for science subjects is 70. This is also due to the conventional learning strategies used by schools which are still teacher-centered methods which make students feel bored so that they are less able to channel the creativity they think about. Based on the results of research conducted by Lilis Nurhayanti (2018) it was also found that students' critical thinking skills are still relatively low or have not developed. This is evidenced by the low average achievement of students' correct answer categories, the low critical thinking skills of students are also caused by students not being accustomed to being presented with active learning that maximizes students' thinking potential. As stated by Tania Tamara (2017) that the low critical thinking skills of students are also caused by the lack of student motivation in learning, the lack of student motivation in learning is characterized by the few responses or responses from students to teacher questions, many students who do not pay attention when the teacher is explaining the lesson material, students' delays in collecting assignments and others.

This causes students to become bored in receiving learning materials and students are reluctant to express their own opinions so that students are not trained to become critical thinkers. These problems can occur because the implementation of learning in the classroom is still monotonous, teachers have not yet implemented innovations in learning such as using learning models. A learning model is a plan or pattern that is used as a guideline in planning learning in the classroom. The learning model refers to the learning approach that will be used, including teaching objectives, stages in learning activities, learning environment, and classroom management. for that teachers need to use variations in teaching, one of which is the use of the right learning model with the learning material to be taught. Choosing the right and innovative learning model can help students to focus and be active during the learning process (Azhar et al, 2024).

There are various factors that cause students' critical thinking skills not to develop, namely first, the curriculum is designed with broad material targets so that teachers focus more on completing the material. This means that the completeness of the material is prioritized over students' understanding of the concept of the material. Second, the learning process in the classroom carried out by teachers only by conveying information (lecture method) activates the teacher more while the students only listen and imitate what is given by the teacher. Third, the teacher only provides sample questions, then continues by giving practice questions that are routine and lack critical thinking, then the teacher gives an assessment (Azhar et al, 2024).

Motion and force material is material related to everyday life. Based on the achievement of science learning in grade VII, namely "At the end of phase D, students are able to understand the relationship between the definition of motion and force, explain the variables that affect motion and force, know the types of motion and force, are able to explain motion and force," there is knowledge that is abstract and requires deep understanding so it is not appropriate if the material taught is only verbal through image media. Motion and force are also one of the physics materials that require various media in their delivery so that they can be understood by students. For example, the concept of motion, displacement, speed, velocity, acceleration, deceleration and Newton's laws, students feel confused when understanding the concept and in applying various example questions in this material. To overcome this, a learning model is needed that can make it easier for students to understand these concepts (Kemendikbud, 2021).

Based on the description above, a suitable learning model is used to determine the level of students' critical thinking skills, namely using the inquiry learning model. The inquiry-based learning model is seen as being able to encourage students to find concepts and apply their mastery of the material they have in everyday life. One alternative inquiry learning model that has the potential to improve students' critical thinking skills is using the Experiential learning model. The Experiential learning model is a learning model that makes the learning process use experience as a medium, Experiential learning invites students to critically view events encountered in everyday life and conduct simple research to find out what actually happened and then draw conclusions together (Nurhasanah,et al, 2017).

The purpose of this study was to describe the level of critical thinking skills of students who apply the Experiential Learning model and to determine the differences in the level of critical thinking skills of students between classes that apply the Experiential Learning model and classes that apply the conventional learning model on the material of motion and force of class VII of SMPN 46 Pekanbaru.

The Experiential learning model is to facilitate students in pouring out the knowledge they have gained, students are invited to go into the field to gain experience and pour out the results of their experiences in the form of writing. Students must be familiar with the environment as a means of learning. This model not only provides insight into conceptual knowledge but also provides experience to students. Dewey argues that experience is the heart of human life that will lead it towards growth and maturity. From this opinion, the learning that is carried out should be able to provide meaningful experiences to students so that they continue to grow and develop in all aspects of life. (Syarifah, 2017).

Critical thinking skills will enable students to make decisions or take action on problems they face. Critical thinking is part of high-level reasoning and it is very important for children to hone these skills, although critical thinking skills often receive less attention (Azhar et al, 2024).

2 Research Methodology

The type of research used in this study is a quasi-experiment. Quasi-experimental research is conducted to determine the effect of a treatment on the characteristics of the subjects studied. In addition, according to (Latifa, Verawati and Harjono, 2017), quasi-experimental research is research to test causal relationships, where researchers provide treatment to subjects to determine whether the treatment has an impact or influence on certain outcome variables or factors.The research design used is Posttest Only Non-equivalent Control Group Design, namely there are two groups, the experimental class, namely the class given treatment and the control class, namely the class not given treatment (Erwan & Dyah, 2017).

The treatment class was given learning using the experiential learning model, learning began by asking again about the material before motion and force and then after that an experiment on motion and force would be carried out. For the control class itself, the active lecture method and conventional media were used during the learning process. After the learning was carried out in both classes, students were then given a final test or posttest to determine the increase in students' critical thinking skills on the material of motion and force.

Tabe 1. Research Design

Class	**Treatment**	***Posttest***
Eksperiment	X	O_1
Control	-	O_2

Sumber : (Sugiyono, 2021: 132)

Information :

X = Treatment by applying the Experiential Learning model

O_1 = Posttest administration for experimental class

O_2 = Posttest administration for the control class

After the learning of the motion and force material was completed, both groups were given a posttest (O1 and O2) in the form of a critical thinking test. The posttest scores obtained by both groups (O1 and O2) where the scores will be analyzed to get an overview of the level of critical thinking of students on the motion and force material after the implementation of the learning.

This research was conducted at SMPN 46 Pekanbaru. The implementation time was in the odd semester of the 2024/2025 academic year. The population in this study were all students of class VII of SMPN 46 Pekanbaru in the 2024/2025 academic year consisting of 5 classes with a total of 200 students. The data collection method used in this study was a test of students' critical thinking skills.

The sample in this study was conducted with a normality test and a homogeneity test on the previous daily material test, namely temperature, heat and expansion. The sample used was a class that was normally distributed and homogeneous. The sample in this study was two classes, namely the experimental class and the control class with both classes having similarities (homogeneous). If all classes are homogeneous, then the sampling technique is carried out randomly. The experimental class is the class that is treated with the Experiential Learning model and the control class is the class that is applied to the conventional learning model.

The data collection method used was a critical thinking ability test in the form of a posttest consisting of 6 descriptive questions that included critical thinking indicators and were given to the experimental class which was used to measure the extent of students' critical thinking abilities in studying motion and force.

There are 2 research instruments used, namely learning devices and data collection instruments. Learning devices consist of learning outcomes, motion and force material modules, LKPD. While data collection in this study is in the form of a critical thinking ability test in the form of descriptive questions, which include question grids that cover indicators and learning objectives of motion and force material.

Data analysis techniques are methods used to manage data so that information from research that has been carried out can be presented. Analysis of research data is carried out with the aim of testing the truth of the hypothesis proposed in the study. The hypothesis that has been formulated will be analyzed using the t-test. However, before testing the research hypothesis, a prerequisite test for data analysis will first be carried out using the normality test and the data homogeneity test.

Descriptive analysis is analyzing data by describing or depicting the data that has been collected as it is without intending to make conclusions that apply to the public or generalization. The descriptive analysis referred to in this study is to provide an overview of the results of students' critical thinking skills where students' critical thinking skills are analyzed through the average percentage of the final score of understanding of critical thinking skills of all students per indicator. The values obtained are then grouped into 5 categories, namely very high, high, quite high, low, and very low. Categorization of students' critical thinking skills can be seen in table 2.

Tabel 2. Pecategorizing students critical thinking abilities

Value range	Category of students critical thinking abilities
$85 \leq X \leq 100$	Very high
$75 \leq X < 85$	High
$65 \leq X < 75$	High enough
$55 \leq X < 65$	Low
$0 \leq X < 55$	Very low

Sumber : (Salsadila, 2022:29)

Inferential analysis is an analysis aimed at drawing conclusions. This analysis can only be done if the data analyzed is taken from probability sampling or random samples (Agus and Dyah, 2017). Inferentialanalysis is carried out to determine the differences in students' critical thinking levels after the Experiential Learning model is applied to the experimental class through hypothesis testing. Before conducting a hypothesis test, a prerequisite test is carried out, namely a normality test and a homogeneity test. The normality test in this study was carried out using the Kolmogorov-Smirnov test technique with

the help of SPSS. The criteria for normality testing are as follows, if significant, p ≥ 0.05 then the data is normally distributed, and if significant, p <0.05 then the data is not normally distributed.

Homogeneity test using Levene's test with SPSS assistance. The test criteria are if F count > F table means not homogeneous and vice versa. The criteria are, if significant, p ≥ 0.05 then the data is homogeneous, and if significant, p <0.05 then the data is not homogeneous. Hypothesis testing is carried out to test the accuracy of the data based on the data obtained from the research sample. If the data obtained is normal, the technique used in the hypothesis test is quantitative data analysis using the independent sample t-test technique. If the data obtained is not normally distributed, then the method used to test the data is the Mann Whitney test (Dwi, 2021). The hypothesis test (t-test) in this study aims to determine whether there is a significant difference in the level of critical thinking between the control class that applies the conventional learning model and the experimental class that applies the Experiential Learning model on the motion and force material of class VII SMPN 46 Pekanbaru. The hypothesis test is said to be significant at p ≤ 0.05. In this study, the following hypotheses were tested in this study:

H_o : There is no significant difference in the level of students' critical thinking skills between the experimental class that applies the Experiential Learning Model and the control class that applies conventional learning on the material on motion and force of class VII of SMPN 46 Pekanbaru.

H_a : There is a significant difference in the level of students' critical thinking abilities between the experimental class which applies the Experiential Learning Model and the control class which applies conventional learning on class VII movement and force material at SMPN 46 Pekanbaru.

3 Result and Discussion

The results of both analyzes are as follows:

3.1. Deskriptive Analysis

This research uses a quasi-experiment design with a nonequivalent posttest only control group design. The sample in this study consisted of two classes, namely class VII B as the experimental class and class VII E as the control class. The data obtained from this research is in the form of a posttest which was answered by students after applying the Experiential Learning model to the material on motion and force in class VII B and conventional learning on the material on motion and force in class VII E at SMPN 46 Pekanbaru. The instrument for assessing students' critical thinking abilities in this research is 6 essay questions, where there are 6 indicators of critical thinking abilities in each question. Students' critical thinking abilities are analyzed through the average percentage of the final critical thinking ability score. Based on the data obtained by the researcher, the critical thinking abilities of class VII B students were grouped as an experimental class with a sample size of 40 students and class VII E as a control class with a sample size of 40 students. This can be observed in table 3.

Tabel 3. Grouping critical thinking abilities

No	Score	Group	Eksperiment Class		Control Class	
			Student	Percentage (%)	Students	Percentage (%)
1	85 ≤ X ≤ 100	Very high	23	57,5	9	22,5
2	75 ≤ X < 85	High	8	20	11	27,5
3	65 ≤ X < 75	High enough	4	10	11	27,5
4	55 ≤ X < 65	Low	1	2,5	2	5
5	0 ≤ X < 55	Very low	4	10	7	17,5

Average	80,82	72,49
Category	High	High enough

Based on table 3 with a total of 40 students for the experimental class and 40 students for the control class, it can be seen that there is a difference in the percentage of students' critical thinking skills between the experimental class which applies the Experiential Learning model and the control class which applies the conventional learning model. In the experimental class, the average percentage of critical 72,49 thinking ability results obtained by students was 80.82 in the high category and in the control class it was in the quite high category. This shows that the critical thinking abilities of students in the experimental class which applies the Experiential Learning model are higher than students in the control class which applies conventional learning. The final score obtained by students includes the average score for understanding critical thinking skills per indicator and the average student score for all indicators can be seen in graphical form in Figure 1.

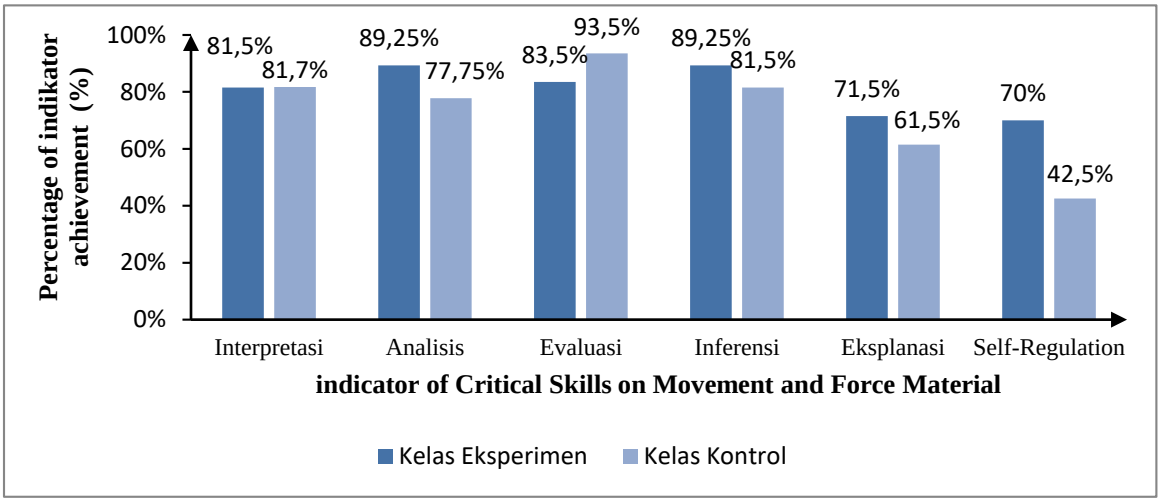

Figure 1. Analysis graph of correct answers per indicator between experimental classes and Control Class

Based on Figure 1, the average percentage of students' critical thinking abilities per indicator is different between the experimental class and the control class. The average posttest score for each indicator in the experimental class tends to be higher than the control class. This shows the influence of differences in the treatment given to the experimental class and the control class.

Analysis of indicators in the experimental class shows that of the six indicators of students' critical thinking skills, the analysis and inference indicators are the indicators with the highest score, namely 89.25%. Meanwhile, the self-regulation indicator is the indicator with the lowest value, namely 70%. Meanwhile, analysis of indicators in the control class shows that of the six indicators of students' critical thinking skills, the evaluation indicator is the indicator with the highest score, namely 93.5%. Meanwhile, the self-regulation indicator is the indicator with the lowest value, namely 42.5%.

3.1.1. Interpretation

Interpretation is the ability to express meaning from various data experiences. Interpretation includes the sub-skills of categorizing, conveying significance, and clarifying meaning. In this question, students are given a picture of a moving motorbike and a child who wants to cross the road, where the motorcyclist wants to stop so that the child can cross the road, then students are asked to draw meaning from this incident. Based on Figure 1, of all students, the number of correct answers for students in the experimental class was 81.5% in the high category, while the number of correct answers for students in the

control class was 81.7% in the high category. The interpretation indicators are supported by research by Rezky Hidayanti (2019) which states that experimental class and control class students are able to draw meanings that are in accordance with what the question asks for clearly and precisely to support the meaning classification made. Even though the number of correct answers from students in the control class was higher than students in the experimental class, both were in the same category.

3.1.2. Analysis

Analysis is the activity of identifying inferential and actual relationships between statements, concepts, descriptions to express beliefs, judgments and experiences, reasons, information and opinions. Analysis includes testing data, detecting arguments, analyzing arguments as a sub skill of analysis. In this question, students are given a picture of two cars on a straight track in opposite directions, then students are asked to determine the distance between the two cars. Based on Figure 1, of all students, the number of correct answers for experimental class students was 89.25%, in the very high category, while the number of correct answers for control class students was 77.75%, in the quite high category. In this analysis indicator, the number of correct answers for experimental class students is higher than that of control class students. This is because students in the experimental class were given direct experience questions through simple experiments, while those in the control class were not.

3.1.3. Evaluation

Evaluation is an activity of assessing the credibility of statements which are reports or descriptions of perceptions, experiences and assessing the logical strength of inferential relationships, descriptions, or other forms of representation. In this question, students are given a story problem about acceleration in which students are asked to provide reasons for the problems in the story problem. Based on Figure 1, of all students, the number of correct answers for experimental class students was 83.5% of students in the high category, while 93.5% of control class students were in the very high category. A comparison of the level of students' critical thinking abilities between the experimental class and the control class shows that this indicator has not too much difference and students who answered correctly are still in the very high and high categories. This can happen due to internal or external learning factors for each student and in the evaluation indicator questions students can be said to have mastered the material.

3.1.4. Inference

Inference is an activity to draw conclusions from what is asked logically from existing statements and problems. In this question, students are given a question in the form of a problem situation that is often encountered in everyday life, then students are asked to determine conclusions from this event. Based on Figure 1, of all students, the number of correct answers for experimental class students was 89.25% of students in the very high category, while the number of correct answers for control class students was 81.5% of students in the high category. The comparison of the level of students' critical thinking abilities between the experimental class and the control class on this indicator did not have a big difference and students who answered correctly were still in the very high and high categories. This can happen because during the learning process, students in the experimental class were more active in asking questions and were critical compared to control class students who were quite active in asking questions.

3.1.5. Eksplanation

Explanation is an activity that is able to state the results of reasoning, explaining conceptual and contextual aspects which are the essence of explanation. In this question, students are given a situation where there are two children pushing a table in opposite directions with the same force which makes the table remain stationary, then students are asked to explain why the table remains stationary even though the two children have pushed it. . Based on Figure 1, of all students, the number of correct answers for

experimental class students was 71.5% of students in the quite high category, while the number of correct answers for control class students was 61.5% of students in the low category. In this explanatory indicator, the number of correct answers for experimental class students was higher than that of the control class.

3.1.6. Self-regulation

Means self-consciously monitoring one's cognitive activities, the elements used in the results obtained, especially by applying indicators in analysis and evaluation for one's own assessment. In this question, students are given a question to write down the sound of Newton's 1st law and its application in everyday life, then students are asked to write down the sound of Newton's 1st law and examples of it in everyday life according to what the teacher has explained in class during the process. learning. Based on Figure 1, of all students, the number of correct answers in the experimental class was 70% of students in the quite high category, while the number of correct answers in the control class was 42.5% of students in the very low category. In this self-regulation indicator, the number of correct answers for experimental class students was higher than for control class students. This is because the experimental class students were given learning treatment using Experiential, which in this learning emphasized student experience as a learning medium where the students had carried out simple experimental practices regarding style, while the control class students were given conventional learning treatment where the students only listened to the teacher's explanation. without carrying out direct experimental practice. This is in line with previous research implemented by Marfiatul Hajjah, et al (2022). This researcher states that the Experiential learning model can influence the level of students' critical thinking abilities.

3.2. Inferential Analysis

Before carrying out a hypothesis test to see the differences in learning outcomes between the experimental class and the control class, a prerequisite test is carried out first, namely the normality test and homogeneity test. The normality test uses SPSS 27 with the Kolmogorov-Smirnov test because the number of samples used is >50, namely 80 students. The results of the normality test on the posttest results on movement and force material showed that the data were not normally distributed for the experimental class and control class.

Based on the results of the normality test on cognitive learning outcomes on movement and force material in the experimental class, a significance value of 0.001 was obtained and the control class had a significance value of 0.001, where the significance value of the experimental class and control class was <0.05 so that the prerequisite tests for conducting hypothesis testing with non-parametric statistics were met. using the Mann Whitney hypothesis test. Hypothesis testing aims to see whether there is a difference in the cognitive learning outcomes of the experimental class and the control class, where the hypothesis proposed is H_0 which shows that there is no difference in the level of students' critical thinking abilities between the experimental class and the control class after implementing treatment with the Experiential learning model at SMPN 46 Pekanbaru. H_a shows that there is a difference in the level of students' critical thinking abilities between the experimental class and the control class after implementing treatment with the Experiential learning model at SMPN 46 Pekanbaru.

The results of the Mann Whitney test obtained using the SPSS 27 program are in Appendix 13. It was found that the significance value was 0.004, this means the significance value is smaller than 0.05. This means that if the significance value is smaller than 0.05 then $H0$ is rejected and Ha is accepted. This means that the level of critical thinking skills of experimental class VII B students is better than that of control class VII E students.

The results of the research in the form of descriptive analysis and inferential analysis show that the level of critical thinking skills of experimental group students is better than that of control group students. So it can be concluded that there is a significant difference in the level of students' critical thinking abilities between classes that apply the Experiential learning model and classes that apply conventional learning

models in class VII movement and style material at SMPN 46 Pekanbaru. It can be said that Experiential Learning can be used to improve students' critical thinking abilities.

4 Conclusion

Based on the results of the research and discussion that have been presented, regarding students' critical thinking abilities through the Experiential Learning model on movement and force material at SMPN 46 Pekanbaru, it can be concluded that there are differences in students' critical thinking abilities between the experimental class that applies the Experiential Learning model and the control class that applies conventional learning model. Where the percentage of aspects of critical thinking ability in the experimental class is higher than the percentage of critical thinking ability in the control class. Thus, it can be concluded that the application of Experiential Learning in the science learning process on movement and force material at SMPN 46 Pekanbaru is effective in improving students' critical thinking abilities.

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