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Influence of Predict Observe Explain (POE) Worksheet on Critical Thinking Ability on Impulse and Momentum

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Abstract: The study aims to determine the influence of the use of POE-based worksheets against the learners ' critical thinking ability on impulse and momentum material. This study was conducted in one of the state high school in Bandarlampung, in the even semester of the school year, 2019/2020. The Research Population is all students of class X MIA. The design of this research uses the Non-Equivalent Pretest Posttest Control Group Design. This study uses a purposive sampling technique with X-grade samples MIA3 amounted to 36 learners as experimental classes and X-grade MIA4 numbered 36 students as control classes have relatively the same initial skills before the researcher performs the treatment. The results of the Independent sample T-Test show POE-based Worksheets on impulse and momentum material have a significant effect on learners ' critical thinking skills. Classes using the worksheets POE learning model showed higher critical thinking abilities with an average of N-Gain 0.70 versus a control class not exposed to the worksheets model Predict-Observe-Explaindengan N-Gain 0.60. This suggests that the use of POE-based worksheets in this research considerably influences learners ' critical thinking skills.

Keywords: Critical thinking ability, Momentum impulse, Predict observe explain

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INTRODUCTION

Learning is a process of student interaction with educators and learning resources in a learning environment (Ministry of National Education, 2003). Effective learning can be realized if knowledge, science, or concepts that want to be delivered can be conveyed well to the learners. Many factors can affect the realization of effective learning processes such as the selection of learning strategies, teaching methods, learning models, and learning media used by educators. Effective learning not only relies on educators.

Learners also have to act actively, not only to receive passive science from their teachers. Judging from the problem, the media in the process of delivery is important so that the progress of the learning process well, as stated by Husein, *et.al.* (2017) that the use of learning media can improve the critical thinking skills of learners. One of the media that can be used to help teach learning activities between learners and teachers is with the use of learning media in the form of student Worksheets. Worksheets is made bet to help students find a concept both through practicum and theory and apply various concepts that have been found. (Mayasari, Syamsurizal, & Maison, 2015) revealed that the worksheets used at the school currently does not train students to investigate the investigation because it contains only a collection of questions to be undertaken. Learners will be overwhelmed because they have to answer the questions not to understand the material.

In this case, Worksheets is required Predict, Observe, Explain (POE) which aims to facilitate the exploration activities of students so that learners are expected to build and understand the concept of the material being taught. POE's learning model is a learning model centered on learners who can train how students think about an existing phenomenon (Falah, Hartono, and Yulianti, 2017). POE Learning Model can improve individual learners ' critical thinking skills (Rahayu et al., 2015). In a study, it showed that mastery of the critical thinking skills of learners using POE learning models is better than using conventional learning models (Sudiadnyani, Sudanah, Garminah, 2013).

The observation results of teachers and students in SMA Negeri 5 in Bandar Lampung, the lessons conducted in the classroom have not used POE-based Worksheets. Worksheets used in the class is Worksheets which is commonly sold by the issuer. Learning is dominated by teachers and still interpreted as a theoretical study because it does not include problems that apply the learning in daily life and has not been done to support the theoretical concept in learning, so students can not develop their skills optimally, reluctant to think and tend to only accept the material without considering it will result in Padakemampuan critical thinking learners. As a background, researchers want to implement the use of POE-based Worksheets to determine its impact on student thinking skills critically towards impulse and momentum learning materials.

This research aims to determine the influence of the use of POE-based Worksheets on impulse and Momentum material to the critical thinking ability of students in SMA Negeri 5 Bandar Lampung can be used as a key in conducting learning in class to implement POE based Worksheets in enhancing the critical thinking skills of learners.

METHOD

The design of this research uses the Quasi-Experimental Design method with a Non-equivalent Control Group design, which is a group of subjects given a certain treatment (experimental), while one group is used as a control class group. This Design is *pretest* Before being given treatment and posttest after treatment. The experimental classes were given treatment using POE-based Worksheets, while the control class used Worksheets that was commonly used in schools. Results of Pretests and posttests in both classes of subjects compared.

In the research design above O1 showed pretests in experimental class, O3 showed Posttest in the experimental class. X1 shows learning treatment using POE-based Worksheets. X2 shows the learning treatment using Worksheets which is commonly used in schools. O2 shows a pretest in the control class, O4 shows a posttest on the control class. There are pretests for both the experimental class and the control class (O1, O2), which can be used as the basis for determining changes. Posttest administration (O3, O4) at the end of the activity will be able to show how far due to treatment (X1, X2).

Research Design & Procedures

The design of the research used is Non-equivalent Control Group Design, which is a group of subjects given a certain treatment (an extension), while one group is used as a control class group. This design has pretests before being given treatment and posttest after being given treatment. The research started at SMA Negeri 5 Bandar Lampung on Tuesday 18 February 2020 to 03 March 2020. Data collection is done after learning activities are conducted. The procedure is the observation of research and implementation of research (learning activities and data collected).

Population and Sample

The population of this study is all students of the X-grade MIA in SMA Negeri 5 Bandar Lampung in the second semester of the 2019/2020 school year, numbering 8 classes. Samples are part of the number and characteristics that the population belongs to. Sampling in these study techniques Purposive Sampling. Sampling was performed on students of the X-grade MIA, with 2 classes taken as experimental class samples (X MIA-3) and control class (X MIA-4.).

Data Collection and Instrument

The steps are taken in collecting the research data, ie by giving pretests before learning and giving posttest at the end of learning. Assessment of learning outcomes was intended to see the results of learning in the form of student cognitive values gained from the provision of critical thinking skills to review the critical thinking skills of learners after learning to use the Worksheets POE model on the experimental class and using conventional Worksheets in the control class. The instrument used in this study was about Essay with a cognitive level of C1-C6 with a total of 15 items with an alpha Cronbach 0.879.

Data Analysis

The data analysis techniques in this study used prerequisite tests such as normality testing, variance homogenization test, and N-Gain test. To test the hypothesis using the T-test for two free samples.

RESULT AND DISCUSSION

The results of the class data experiments obtained are the recapitulation of the pre test and post-test values in the control and experiment classes along with the analysis of the answers of each number of questions answered by the students. Testing and analysis of data are done using the help of SPSS 26.0. Tests carried out in the form of validity and reliability tests of instruments conducted before the study, then the calculation of N-Gain, followed by a test of normality and homogeneity, and closed with a hypothesized test using the Independent Sample T-Test.

In the class of the experiment, it appears that learners are quite active in the learning process using WORKSHEETS POE models. The quantitative data of research results obtained from the implementation of learning in the full control and experiment class is presented in Table 1.

Table 1. Quantitative Data control class and experimental class critical thinking ability

	Pretest		Posttest	
Decryption	**control**	**experimental**	**control**	**experimental**
Average	13,06	13,03	62,47	76,7
Minimum	0	0	53,3	70
Maximum	31.6	28,3	81,6	88,3

Improved learners ' critical thinking skills are seen from a comparison of the increased pre-test and post-test grades in the control class and experimental classes. The results can be seen in table 2.

Table 2. Results Pre-Test and Post-Test class experiment and control

Data of research results	**Pre-test**		**Post-test**	
	Control	**Experiment**	**Control**	**Experiment**
Number of students	36	36	36	36
Average test scores	13,06	13,07	62,47	76,77

The post-test results in the two classes were observed in the percentage of critical thinking skills indicators. The result of this percentage calculation is used to see indicators that have low achievements, as well as indicators with high achievements. The research instruments used in this study were 15 questions about the explanation, in which the researchers made the distribution of the number of questions to each indicator based on the difficulty of the indicator. So the division of the question into each indicator differs. The result of the percentage achievement of critical thinking skills indicator can be seen in Table 3 and Table 4 below.

Table 3. Percentage (%) Pre-Test results in learner's critical thinking skills based on test item analysis

No.	**Indicator of Critical thinking ability**	**Class Control %**	**Class Experiment %**
1, 2, 4, & 6	Giving explanation Simple	16,84	18,05
3, 5, 7, 10, & 14	Giving explanation Further	19,72	14,86
8, 9, 11, 12, 13, & 15	Organizing strategies and tactics	4,86	8,33
	Average	**13,80**	**13,74**

Table 4. Percentage (%) Post-Test Results Critical thinking skills learners based on test item analysis

No.	Indicator of Critical thinking ability	Class Control %	Class Experiment %
1, 2, 4, & 6	Giving explanation Simple	77,77	86,45
3, 5, 7, 10, & 14	Giving explanation Further	61,38	72,5
8, 9, 11, 12, 13, & 15	Organizing strategies and Tactics	53,00	72,22
	Average	**64,05**	**77,05**

The test result of the assay instrument in the form of an essay before use in research, conducted in advance of the test process in the form of validity test and reliability test. The test is conducted to ensure that the test instrument to be used is valid and reliable. This test is done by testing about 15 items to 70 learners who act as respondents. The instrument test results were obtained valid with a 0,427-0,753 range with Cronbach's Alpha value of 0.879.

Research Data testing results obtained after Pre-Test and Post-Test result data is obtained, the Data is analyzed using the help of SPSS 26.0. Tests conducted in the form of normality test and homogenization test in the pre-test, post-Test, and N-Gain data. The normality test is performed to know a group of data has a normal or abnormal distribution spread. The normality test done with the Smirnov Kolmogorov test can be seen in the following Table 5.

Table 5. Test Data normality

	Class	Kolmogorov-Smirnov[a]		
		Statistic	Df	Sig.
Pre Test Score	pre-test control	,131	36	,0,126
	pre-test experiment	,127	36	,0,153
Post Test Score	post test control	,115	36	,0,200
	post test experiment	,154	36	,0,061

From the results of the test, the value of the significance of all data is more than 00.05. Following decision-making guidelines, it can be concluded that the pre-test and post-test values in both classes have been distributed normally. Test homogeneity of pretests data and posttest students conducted using the Levene Statistic test with the equivalent of $\alpha = 0.05$ significance. Test results of pretests data homogenization and posttest students can be seen in the following Table 6.

Table 6. Test Data homogeneity

Data	*Levene Statistic*	*df1*	*df2*	*Sig.*
Pretest	5,528	1	70	0,072
Posttest	5,528	1	70	0,091

Calculation N-Gain value N-Gain or Normalized Gain is obtained from pre-test and post-test data. Both classes (control classes and experimental classes) are calculated the N-Gain value obtained. The Normalized Gain value is calculated. The calculation results can be seen in the following Table 7.

Table 7. Calculation of N-Gain class controls and experiments

No	Class	*Pretest*	*Posttest*	*N-gain*	Category
1	Control	13,05	64,05	0,60	Medium
2	Experiment	13,74	77,05	0,70	Medium

From the table, it can be noted that the N-Gain results obtained by the experiment class were higher than the N-Gain owned by the control class. This value of N-Gain is later in further analysis through the prerequisite test (test of normality and homogeneity) and the hypothesis test using the Independent Sample T-Test. The test result of N-Gain data normality carried out through the Kolmogorov Smirnov test with the help of SPSS 26.0 shows the difference of N-Gain between the control class and the experimental class, the average N-gain students ' learning outcomes in the experimental class is higher than the N-Gain student learning outcomes in the control class.

The results showed that there was an increase in higher learners ' critical thinking skills in the experimental class that exposed the worksheets learning model PREDICT-Observe Explain compared to the control class not exposed to the conventional model. The average N-gain comparison of learners ' critical thinking skills in both classes is presented in figure 1 below.

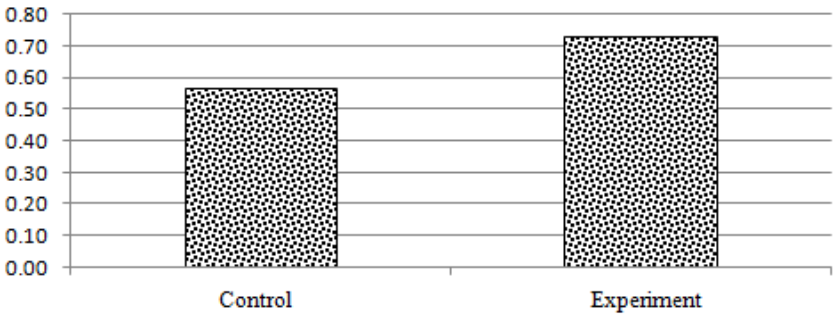

Figure 1. Improved graph of learning outcomes based on N-gain

The percentage acquisition of student's critical thinking skills in experimental classes and control classes based on high, medium, or low category levels can be seen in figure 2 below.

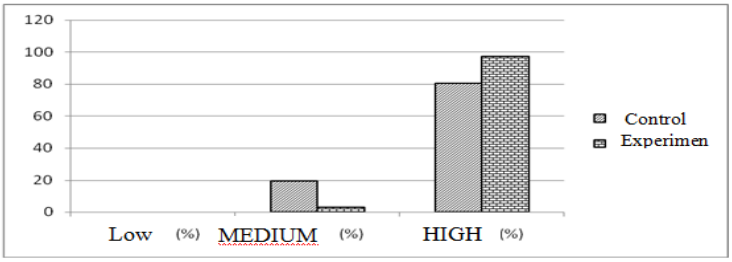

Figure 2. Graph percentage N-gain by category

Based on the graphics it obtained that in the class of experiments and control classes, no students experienced an increase in the skills of thinking critical with low categories or in other words 0% in this category. Further 2.78% of students in the experimental class experienced an increase in critical thinking skills in medium categories, while in the control class there were 19.44% of students experiencing an increase in the critical thinking skills in medium categories. Then the data obtained as much as 97.22% of students in the experimental class experienced increased crits thinking skills in the high category, while in the control class there was an 80.56% increase in the high category.

After learning the results of the N-gain test, it was subsequently tested using the independent T-Test sample test to determine the use of an influential POE-based worksheets. Based on data analysis and hypothesis testing that has been done for the critical thinking ability acquired sig value. amounted to 0.000. The value is smaller than 0.005 which means the zero hypotheses (H0) are rejected. This indicates that there is an influence on the use of POE-based worksheets on the critical thinking skills of the students. So it can be said that the influence of the use of POE-based worksheets in this research has a major influence on learners ' critical thinking skills.

Besides, if reviewing the results of the learners ' responses to each item presented in Table 4.3 and Table 4.4 on the research results, it is possible to know that achieving each indicator of the highest critical thinking skills occurs in the experimental class. When viewed from the improvement, the experimental class also shows a higher increase than the control class on each indicator. This is following the research results expressed by Saminan, DKK (2016) indicating that Improved critical thinking skills in experimental classes One is characterized by the increased achievement of each indicator of critical thinking skills after treatment. The chart of achievements of each indicator can be seen in figure 3 below.

Some of the things that cause students ' critical thinking skills in experimental classes that implement the use of the worksheets learning model Predict-Observe-Explain are increasing higher are students who engage more actively in the learning process, discuss each other, exchange information, and students more creatively in conducting learning activities in the classroom, so that students do not feel depressed in understanding the lessons they convey.

Learning with POE models involves learners directly in conducting activities and fostering scientific attitudes because in his studies through the 3 main steps of scientific methods that are predicted or predict, observe or observe to test the predicted outcome, and explain or explain the initial process to the end of the learning. Through this step, the activity can stimulate learners to be more creative especially when formulating predictions. The learning process is more interesting because learners are not only listening but also observing events that occur through observation so that learners have the opportunity to compare theories (allegations) with reality.

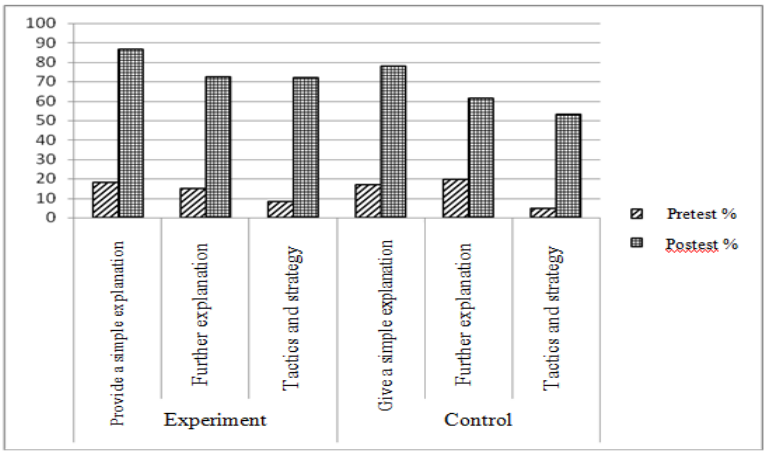

Figure. 3. Average achievement chart based on Indicator of Critical thinking ability indicator Pre-Test and Post-Test results

Thus learners are more convinced of the truth of learning materials. This is the case with the opinions of Atriyanti and Hadisaputro (2015) stating that worksheets POE implementation can develop the analytical and evaluation skills of learners. Through predict activities, learners can develop their thoughts by restudying the knowledge he has about the problem given so that there will be a conclusion that can prove their predictions. It is also following the opinion of Nurmalasari,*et.al.,* (2016) every student will try to answer according to their respective knowledge. At the observed stage, learners perform observations where they find a fact that can prove the truth of their predictions. Through these activities, they can also analyze every variable on the observation so that it will acquire real knowledge. At the explained stage, learners can explain the relationship between the predicted outcome and the observation. At this stage, learners evaluate the extent to which the concept has been mastered, so that they have indirectly linked prior knowledge with the knowledge that was newly acquired through the study of worksheets POE.

CONCLUSION

Based on the results of the research and discussion, it can be withdrawn that the use of POE-based worksheets has a significant effect on the critical thinking ability of impulse and momentum material, evidenced by a significance value of 0.000 on a 95% confidence level. Improvement of students ' critical thinking skills in the class that use the worksheets learning model Predict-Observe-Explain is higher with an average of N-Gain 0.70, compared with the control class that does not incur the learning model with the acquisition of N-gain of 0.60. So it can be said that the use of POE-based worksheets in this research has considerable influence on the learners Under the research done, the authors suggest that teachers be able to perform mature preparations by considering allocating the exact time at each of the steps in the Learning model PREDICT-Observe-Explain.

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