

IMPLEMENTATION OF POEE (PREDICT OBSERVE EXPLAIN EXPLORE) LEARNING METHOD TO INCREASE STUDENTS' UNDERSTANDING CONCEPT ON KINETIC THEORY OF GASES IN GRADE XI OF SMAN 1 KRIAN

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Abstract

The goals of this research were to describe the practicality POEE learning method process to increase students' understanding concept in term of teacher's activities treatment and students' activities treatment during the POEE learning process, and to describe the effectiveness of POEE learning method to increase students' understanding concept in term of significance of differences in pretest and posttest score, enhancement of understanding concept and students' responses after POEE learning method has been done. This research was pre experimental by one group pretest posttest design. The sample of this research was determined by ensure that the population normally distributed and homogenous ability first, so it obtained grade XI MIA 1 of SMAN 1 Krian as the sample. The results of the research indicate that POEE learning method can be performed and implemented very well. While using the POEE learning method, Students could perform noticeably very well. The result explain that POEE learning method could be implemented and successfully increased, students' activities when they were learned was categorized by very good. There are significant differences in pretest and posttest values so, students' understanding concept could be increased by the average enhancement 0,6 and its categorized as very good. Students' response of POEE learning method had range 76%-90% by good until very good as the criteria. Based on that result, it showed that implementation of POEE learning method could increase students' understanding concept.

Keywords: POEE, understanding concept

INTRODUCTION

Physics is one of the subjects that can develop students' thinking ability to solve problems in everyday life. Based on the standard content of Physics learning at high school level, Physics learning aims to develop reasoning ability and making analysis. Students use concepts and principles of Physics to explain phenomena they found in everyday life and solve the problems by qualitatively and quantitatively. It requires students to be able to explain phenomena in everyday life and solve them by qualitatively and quantitatively (Suhendi et al., 2014). To be able to realize the purpose of learning, it is critical that students are able to understand the correct concept. By having good understanding of the concept of Physics, students will benefit from it in their everyday life. In addition to that, with the correct understanding of the concepts, one can develop the concept so that it becomes a new invention that will be beneficial for humanity and the surrounding environment.

While learning physics in high school, the teaching materials are still delivered using a mathematical abstraction approach without relating between physics concepts and real problems in everyday life. The relevance of one physics concept to another is still less emphasized. To overcome this, the teaching approach

that needs to be conveyed is to put more emphasis on the mastery of the concept and make the mastery of the concept as the basis for mastering another concept. Mastery of interconnectedness between concepts can help to solve real problems. In addition, some teachers experience constraints on how to embed the concept appropriately in students, especially in abstract or non-material object. Abstract concepts will be more difficult to explain because there is no real example in the student environment. Usually teachers use practicum tools to explain abstract concepts. The practicum tool, however, can only explain symptoms in general without being able to know the physical significance of the symptoms that is being observed (Suseno, 2014). One of abstract material in physics is kinetic gas theory. Based on research that has been conducted by Mahmudah (2013), there are 10 students of class XI IPA SMA Negeri 7 Surakarta in the academic year of 2012/2013 found that made mistakes in solving the problems on the material of kinetic gas theory due to having misconception counted for 56% and due to miscalculation by 44%. Similarly, a research conducted by Safitri (2015) on grade XI students of SMA Negeri Bawang in the academic year of 2013/2014, it was found 40% of students who experienced a misconception for sub material of ideal gas characteristic, sub material of

the law of ideal gas by 55 %, Sub material of kinetic theory of gas by 60%, and for sub material of energy equipartition by 42%. From these data, it can be seen that there were still many students who had difficulty to understand the concept of gas kinetic theory.

Physics provides students experiences through observation, solving problem, predicting, and forecasting a natural phenomenon in the classroom. Hence, each student can understand systematically and scientifically about the concepts and principles of Physics. Therefore, one of the most appropriate approaches to the material of Physics is the constructivism approach. Constructivism is an approach that emphasizes on students to develop their own knowledge and understand, however, it is possible that students can still make mistakes in constructing such knowledge and understanding.

Students' understanding of the Physics concept relies heavily on the student's initial knowledge of that concept. Student's initial knowledge can be seen when they present a phenomenon in front of the class and then explain that phenomenon as they see it with their own eyes, however the explanation sometimes is not in line with the scientific explanation. The discrepancy between students' explanation of a phenomenon with a scientific explanation leads to a misconception or an alternative concept. If this misconception or alternative concept is not rectified, it will be more integrated in their cognitive structure and continue to be misled.

Based on the data of score lists revealed by the subject teacher of Physics class XI at SMAN 1 Krian, there were still many students who had to do the retest on the material of gas kinetic theory, for example in class XI MIA 1, students who did not get retest were 20 of 34 students. It can be said that the understanding of the concept in class XI MIA 1 was still less. After conducting questionnaires and observations of students learning activities from class XII MIA in the classroom, it was revealed that students were rarely involved in the learning process. The learning was still centered on the teacher. There are 31 students said that they were never asked by the teacher to observe a phenomenon related to the material of gas kinetic theory. Further, they stated that the method used by teachers was mainly lecturing method.

There are several ways that can be used to rectify the misconception experienced by students, one of which by using the POE learning method (Predict Observe Explain) (Ibrahim, 2012). The POE learning method comprises some phases that teachers can use to improve students' conceptual understanding (Restami et al., 2013). This learning method has phases that will involve students directly in predicting a phenomenon, observation through demonstrations or experiments, and explain the

relevance between demonstration results or experiments with student initial predictions. This prediction phase is important because this phase reflects the students' initial concepts about the scientific concepts and phenomena. The observation phase requires all the senses to collect data. The next phase is the phase of explaining, at this phase students will explain the relevance between the results of demonstrations or experiments with predictions. If the results of demonstrations or experiments are in accordance with student predictions before, the students will be more confident about the concept they have. On the contrary, if the results of demonstrations or experiments and predictions are not matched then students will try to find explanation of such nonconformities.

According to White and Gunstone (in Keeratichamroen, 2007) the POE learning method is an efficient method to stimulate discussion among students or students with teachers on the concept of science. According to Wah Liew (2004) the benefits of the POE learning method are (1) exploring the initial concept of students, (2) stimulating class discussion, (3) increasing students' motivation to investigate a concept, (4) raising students' curiosity to a problem. Phases in the POE learning method can stimulate the activity of students (Farikha et al, 2015).

Nowadays, the POEE learning method has been developed by several researches, one of them was Hilario (2015). He added one more step to the POE learning method that is the "explore" phase to further improve students' conceptual understanding, hence the learning method used then becomes the POEE learning method (Predict Observe Explain Explore). Students from the experimental group are asked to search the topics in the different experiments. They are also asked to explain the implementation of each concept in hospitals, industries, pharmaceuticals, communities, and even at home (Hilario, 2015). At this phase, students with their groups are asked to look for topics they are studying from other experiments and explain the application of each concept they learn in everyday life.

Based on the description, this study was conducted under the title "Implementation of POEE (Predict Observe Explain Explore) Learning Method to Increase Students' Understanding Concept on Kinetic Theory of Gases in Grade XI of SMAN 1 Krian".

METHOD

The data obtained from this research are in the form of numbers and the results are presented descriptively, therefore, the research method used is pre-experimental method with quantitative descriptive. Meanwhile, the research design is one group pretest posttest design by

which was conducted on one group only without other group as comparison. The research design is described as follows:

$$U_1 \rightarrow L \rightarrow U_2$$

Picture 1. Research Design Outline (Prabowo, 2011)

This research was conducted by implementing POEE learning method to increase students' understanding concept on material of kinetic gas theory, further some analysis were conducted on the significance of pretest and posttest score, the enhancement of student understanding concept, the implementation of learning process and students response.

The sample used in this study was class XI MIA 1. The sample was selected by using random sample selection technique by ensure the population has the ability of distributed normal and homogeneous through the normality and homogeneity test first. The population used was class X SCI, XI MIA 1 and XI MIA 2.

Instruments used for data collection are learning observation sheet, observation sheet of student activity, test sheet (pretest and posttest), and student response questionnaire.

Data analysis techniques used are learning implementation analysis, student activity sheet analysis, normality test, homogeneity test, one side t test, n gain test, and student response questionnaire analysis.

RESULT AND DISCUSSION

The data on the implementation of learning is assessed using the observation sheet of the learning implementation which is filled by three observers. The result of the recapitulation of the implementation of learning is shown in Table 1.

Table 1. Recapitulation of Learning Accomplishment
VG = Very Good

Syntax	Accomplishment	Score Mode Each Meeting	Criteria
Initial motivation	Performed	4	VG
Predict	Performed	4	VG
Observe	Performed	4	VG
Explain	Performed	4	VG
Explore	Performed	4	VG

From all aspects of observation, teachers' ability to implement the POEE learning method was very good. These results indicate that the researcher was successful in managing the class and running all the activities as initially planned in the lesson plan despite there were

some obstacles during the learning process. As result, the implementation of learning with the method of learning POEE on kinetic gas theory can be considered to be effective. An implementation of a learning is considered to be effective if teachers ability to manage learning has reached the category of good or very good (Lince, 2001).

The data of Student activity were assessed using student activity observation sheets conducted by three observers. The result of student activity recapitulation is as shown in table 2.

Table 2. Recapitulation of Students' activity
VG = Very Good

Syntax	Score Mode Each Meeting	Criteria
Initial Motivation	4	VG
Predict	4	VG
Observe	4	VG
Explain	4	VG
Explore	4	VG

The ability of students to grasp Physics learning using the overall POEE learning method was very good. Students could accomplish each phase of student activity planned by the teacher. Although there were some students who missed or did not conduct the activities, but students could be re-conditioned to participate the learning activities. This goes hand in hand with a research conducted by Farikha (2015) which found that the implementation of learning method Predict Observe Explain (POE) with experiment in class XI MIA 3 SMA Negeri 4 Surakarta Academic Year of 2014/2015 could increase student learning activities.

The pretest results were used to determine the students' initial ability and to test normality and homogeneity in order to find out if the students were distributed normally and homogeneously. The result of the normality test analysis is presented in Table 3.

Table 3. Analysis Result of Normality Test

Class	χ^2_{count}	χ^2_{Table}	Conclusion
X SCI	13,56	43,8	Distributed Normally
XI MIA 1	15,27	55,8	Distributed Normally
XI MIA 2	11,96	43,8	Distributed Normally

From table 3, it is known that $\chi^2_{count} < \chi^2_{table}$, therefore, H_0 is acceptable. As result, the samples used are normally distributed

Furthermore, the pretest result was also tested using homogeneity test. Homogeneity test was used to find out if the samples were from population which had homogeneous variance or not. The result of pretest homogeneity test analysis is presented in table 4.

Table 4. Analysis Result of Homogeneity

Class	χ^2_{count}	χ^2_{Table}	Conclusion
X SCI			
XI MIA 1	1,11	5,99	Homogeneous
XI MIA 2			

Based on table 4, it is known that $\chi^2_{\text{count}} < \chi^2_{\text{table}}$, therefore, the H_0 hypothesis is valid. It means that all three populations used in the study is homogeneous.

The result of normality and homogeneity tests performed depicts that the population used was distributed normally and homogeneous. Therefore, samples can be randomly selected from all three classes. In this study, class XI MIA 1 was selected as a sample to represent the population.

In addition, the posttest result of class XI MIA 1 was re-tested using the normality test as it requires to conduct t test on one side. The analysis result of normality-posttest is presented in table 5.

Table 5. Analysis Result of Normality Test

Class	χ^2_{count}	χ^2_{table}	Conclusion
XI MIA 1	9,09	43,8	Distributed Normally

Furthermore, the pretest and posttest result of students class XI MIA 1 was analyzed by using one side t-test. One-side test conducted to examine the significance of differences between pretest and posttest score results. The result of one side t-test analysis is shown in table 6.

Table 6. Analysis Result of one side t-test

Based on table 6, the value of $t_{\text{count}} > t_{\text{table}}$,

Class	t_{count}	t_{table}	Conclusion
XI MIA 1	19,4	2,02	H_0 Refused

therefore, H_0 was refused so it can be concluded that there was significance difference between pretest and posttest score. The POEE learning method has a special syntax for depicting students' theoretical ability that is the predict syntax. In POEE learning method, students will have to think and make a prediction when they are posed to a certain phenomenon which will stimulate students' initial knowledge. In addition, students will conduct experiments or investigations to test the correctness of the predictions they made so that students will give an explanation especially about the correctness between the prediction and the experimental results. At this phase students will find their own scientific. Students will also be able to identify the implementation of concepts that

have been studied in everyday life and will ultimately increase the understanding of the concepts.

This is in accordance with the theory given by Warsono (2013) that by ask students to explain the reason for predictions, the teacher can assess the theoretical ability of the students. It is very useful that teacher know student misconceptions about the theory, and to develop student understanding.

The results of this study are also in accordance with research conducted by Hilario (2015) which stated that the POEE learning method can enhance students' understanding concept of a material. In addition, this study is also same with Bayram (2012) who also suggests that POE learning method can be an effective way to change students' understanding conceptually and increase it.

Further, the gain score was done to determine the improvement of students' understanding which assessed by pretest and posttest, before and after learning. Result of the Analysis n Gain presented in Table 7.

Table 7. Analysis Result of Test n Gain

Class	Gain	Category
XI MIA 1	0,59	Average

N Gain test, it was conducted on the students' pretest and posttest results to measure the impact of the POEE learning method on the students' conceptual understanding on the kinetic gas theory material. From Table 7 it can be seen that the average gain shows the average category. Where there are 14 students with high category, 20 students of medium category and 2 students with low category. Differences in this category occur due to several factors, one of which is there are differences in student conditions, whether mental or physical conditions. At the first meeting, during the experiment, each of the two groups performed a different experiment. This is why students understand only the concepts they find themselves, even though three groups from different groups have present it through the presentation. This resulted in the students are still less able to grasp the concept given. In addition, the student's condition during posttest also has an effect. Before do the posttest, some students joined sports activities therefore, it affects the students' condition while doing posttest.

Students' responses to learning activities were obtained through questionnaire. The result of the percentage of students' responses to the learning is shown in table 8.

Table 8. Percentage of Students' Response

No Questionnaire	Percentage (%)	Category
1	90	VG
2	85	VG
3	83	VG
4	88	VG
5	88	VG
6	86	VG
7	90	VG
8	85	VG
9	76	G
10	89	VG
11	79	G
12	79	G
13	83	VG
14	77	G
15	89	G

VG = Very Good G = Good

The percentage indicates that students are interested in Physics after using the POEE learning method. Students feel that Physics learning using POEE learning method is proper to gas kinetic theory material and can improve students' understanding concept. This is in accordance with research that has been done by Restami (2013) who stated that this learning method can enhance the understanding concept and scientific attitude of students. In addition, students also feel that learning Physics using the POEE learning method can also stimulate students in expressing opinions, more active in learning, and do not feel depressed while learning Physics. This is also in accordance with research conducted by Hilario (2015) who stated that students respond more positively when POEE learning implemented, compared to using conventional method. According to students, PhET media combined with the POEE learning method is complementarily proper. The result of student's questionnaire shows a good and consistent response.

CLOSING

Conclusion

The learning activities on the material of Kinetic Gas Theory of students class XI in SMA Negeri 1 Krian by using POEE learning method to increase students understanding concept was accomplished very well.

Similarly, student activity when given learning was also categorized very good.

There were significant differences in the score of pretest and posttest after POEE learning method to increase students' understanding concept was implemented.

Enhancement of student understands concept from class XI MIA 1 achieved average category.

Student response to the POEE learning method was in the range of 76% -90%, ranging from good to excellent criteria.

Suggestion

The POEE learning method on material of the equation law of ideal gas spend longer time, therefore, the teacher should be able to manage the learning time well.

During the explanation, it is important for teacher to re-emphasize so that students can change their misconception.

It is necessary to analyze every indicator to measure the students' comprehensiveness in each indicator, then give remedial test using different questions for students who have not finished or get score below KKM.

Innovation of instructional media combined with POEE learning method can be added and not only combined with PhET media so that learning becomes more interesting and students will have higher motivation to learn physics.

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