USEJ 6 (1) (2017)

Unnes Science Education Journal

http://journal.unnes.ac.id/sju/index.php/usej

THE COMPARISON OF *PREDICT-OBSERVE-EXPLAIN (POE)* LEARNING MODEL USING EXPERIMENTAL METHODS AND DEMONSTRATION METHODS IN IMPROVING STUDENTS UNDERSTANDING OF PHYSICS CONCEPT IN TEMPERATURE AND HEAT

Yuni Arfiani✉

Natural Science Education Program, Faculty of Education
Universitas Pancasakti Tegal, Indonesia

Article Info

Received December 2016
Accepted January 2017
Published February 2017

Keywords:
Predict-Observe-Explain (POE); experiment methods; demonstration methods; physics concept understanding

Abstract

This research aims to find out the comparison between of the students physics concept understanding who take the lesson using the Predict-Observe-Explain (POE) models with experiment methods and demonstration methods. This research is a quasi-experimental research design pretest-Post Test Control Group Design. The population in this study was 212 students and take 60 students who carried out based on non-random techniques conditional. Samples were taken as many as 60 students divided into two experimental classes. Data collection methods used pretest to obtain data on students' physics concept understanding before being given treatment and post test to obtain data on students' physics concept understanding after being treated. Data obtained were analyzed using Independent Samples T-test. The results showed no difference between the understanding of the student's physics concept understanding who takes the lesson using the Predict-Observe-Explain (POE) models with experiment methods and the demonstration methods. Based on the increase in the average value of pretest and post test, obtained an average value of the experiments class is 6.65, while the larger demonstration class is 8.33. This suggests that physics learning using POE models with experiment methods are worse to improve students' physics concept understanding compared using POE models with demonstration methods.

p-ISSN 2252-6617
e-ISSN 2502-6232

✉Corresponding author:
Yuni Arfiani
Prodi Pendidikan IPA FKIP Universitas Pancasakti Tegal
Jl. Halmahera Km. 1 Kota Tegal, Kodepos 52122
E-mail: yuniarfiani00@gmail.com

INTRODUCTION

The improvement of education's quality is an integrated process to the improvement of human resources (Suparna, 2003). It reflects the attempts done by developed nations in achieving the current sophistication of education there.

Indonesian government has done many attempts to improve education's quality through the development of education in developing the curriculum, education's evaluation system, the enhancement of education's infrastructure, the development of learning material, and teachers' training. The governmental attempts have not proven significant result since it has not coped the whole package of educational development (Suparna, 2003).

Natural science is one of the important knowledge with significant influence to the development of science and technology. One of natural science subjects is physics. The system of teaching and learning of physics at school should always be improved to maintain and reach the indicator of the lesson.

Curriculum 2013 (K-13) has been done in some schools in Indonesia in which it insists Indonesian physics teachers to be more creative in arranging their lesson plans based on the condition and situation surround the students. This curriculum was revised from KTSP with greater emphasis on building students' characters, developing relevant skills based on student's interests and needs, and developing a thematic learning approach (Putra, 2014). Learning model used by the teachers should stimulate student's curiosity and helping them expressing and communicating scientific ideas.

It is important to note that the most common usage of Bloom's taxonomy focuses on cognitive learning skills rather than psychomotor or affective skills (Adam, 2015). Bloom Taxonomy explains that understanding is the second level of important cognitive improvement for the students. Learning results from understanding level is related to simple memorization or simple knowledge. Physics understanding concept is the nearest goal reached for developing the learning material in class besides skills of applying scientific approach. In learning physics, it should be attempted to make the students understand the concepts of the material at first.

Laboratory is one of the media to build physics concept to student's mind. Working in laboratory can help the students know the physical environment around them that is able to teach them scientific processes. (Zaman, 2012)

There have been many studies of science laboratory work over many years, and many reviews of this research (Kerr, 1964; Hofstein & Lunetta, 1982). Given the significance attached to laboratory work in science curriculum statements, textbooks, teacher education programs, and so on, this research attention is not surprising. Laboratory work is almost ubiquitously seen as being of great importance to science education, by some as almost the defining characteristic of this component of the school curriculum (Hart et al., 2000). Some students enjoy learning in the laboratory than learning in class. This thing shows that learning process using experimental exercise is highly needed to help the students in physics in order to help them understanding the concepts and theories of physics to improve their interest about it. (Kurniawan, 2011).

Olubu (2015) states that learning in laboratory gives significant influence to student's character building. Through laboratory activities, students are trained to plan, observe, utilize tools and materials, conclude, and discover concepts based on the experiments.

One of the learning model combining student's cognitive and psycho motor ability can be applied in laboratory is POE (Prediction, Observation, and Explanation) model. The POE model provides an opportunity for students to learn concretely, so that students have a correct and strong understanding of the material being studied (Tanzila et al., 2017). The ability of predicting is also known as the ability of hypothesizing. After that, the teachers ask the students to observe through several experiments. The conclusion of the experiment is matched with the student's prediction. If the student's prediction is right, the students will be more than sure that they understand the concept of the material. But, if the student's prediction is not right, the teacher will explain the students more. Therefore, the students can understand the physics concept well.

Restami (2013) states that there is a significant difference on physic concept' understanding between students with POE model and students with conventional learning

model. The ease of understanding happens since the syntax of POE involves prediction, observation, and explanation and also experimental procedure that accommodate the students in understanding physics concept.

Research about POE was also done by Ma'rifatun (2014). She investigated the influence of POE with experimental and demonstration towards student's achievement in chemistry. The result proved that student's high cognitive achievements happens because of the use of POE with experiment since the intense and active role of students in doing the experiment, therefore, the understanding will be more comprehend than using only demonstration. Ozdemir et al (2011) also applied the learning of POE on acid-base material. Application of POE learning can help to gain a better understanding of scientific concepts.

Further research reviews the application of POE in improving physics understanding of students. This study will be done by comparing the use of POE and demonstration in learning physics. Later, this research is aimed to discover the different influence of using POE (Predict-Observe-Explain) and demonstration in improving high school students understanding of physics.

METHOD

This research was quasi experimental research with Pretest-Post Test Control Group Design. This design used two class, experimental (using POE) and control class (using demonstration). The hypotheses proposed in this research were:

H0: There is no any differences in students' physics understanding using POE (Prediction, Observation, and Explanation) using experiment and using only demonstration method.

Ha: There is a significant difference of students' physics understanding using POE (Prediction, Observation, and Explanation) using experiment and using only demonstration method.

The independent variable of this research was the use of POE model (Prediction, Observation, and Explanation) while the dependent variable was the understanding of physics concept of the students measured by validated physics concept understanding exercises, and the control variable were the learning materials, teachers, learning duration, and students' initiate condition.

The population of this research was 212 students of the X grade of SMA Negeri 4 in which the samples taken were 30 students for the experimental group and 30 students for the control group. The sampling method used was random sampling technique.

The main instruments to obtain data in this research were through diagnostic tests, students' worksheets, pretest, and post test. All those instruments should be able to fulfill the requirement of tests' validity and reliability for data collection. Validity test in this research was done to 45 test items and it was inferred that 41 test items were valid, while the reliability test was using Alpha-Cronbach method. Alpha was developed by Lee Cronbach in 1951 (Cronbach, 1951) to provide a measure of the internal consistency of a test or scale; it is expressed as a number between 0 and 1. Internal consistency describes the extent to which all the items in a test measure the same concept or construct and hence it is connected to the inter-relatedness of the items within the test (Mohsen & Dennick, 2011). Internal consistency is a necessary but not sufficient condition for measuring homogeneity or unidimensionality in a sample of test items (Cortina, 1993).

The technique of analyzing the data was using the difference analysis by t-test in SPSS. Before doing the t-test, the researcher did analysis requirement test with normality test and homogeneity test. Data normality test was done by using One Sample Kolmogorov-Smirnov in SPSS, while the homogeneity tests done by using One-Way Analysis of Variance statistic (ANOVA).

RESULT AND DISCUSSION

The obtained data in this research from posttest and pretests result can be seen in Table 1.

Table 1. Pretest and Post test Results

	Experimental Group		Control Group	
	Pretest	*Posttest*	*Pretest*	*Posttest*
Highest Score	85.0	95.0	80.0	87.5
Lowest Score	50.0	57.5	45.0	55.0
Average	69.33	75.98	66.42	74.75
Deviation Standard	8.51	8.58	8.45	9.20

Table 1 results is continued to be processed with hypotheses test. This test was done after the experimental and control group proven to have samples with normal distribution and homogeneous variance.

Normality test was done using One Sample Kolmogorov-Smirnov Test. The result of the test obtains asymptote Sig. (2-tailed) was 0.936 for experimental group and 0.260 for the control group. It is proven that asymptote Sig. (2-tailed) was > 0.05. It can be stated that control group and experimental group have normal distribution. Homogeneity test was done using One Way ANOVA. The result showed that the Levene Statistic score was 0.027 with 0.870 of significance. It is proven that Sig. 0.870 > 0.05, which can prove that both groups are homogeneous. The test of the students understanding concept can be seen in Table 2.

Table 2. Test of Students Difference in Physics Understanding Concept

	Students Cognitive Learning Outcome	*F-Test*		*T-Test*		
		F	Sig	t	Df	Sig (2-tailed)
Gain	*Equal variances assumed*	13.539	0.001	0.669	58	0.487
	Equal variances not assumed			0.669	39.76	0.489

Based on the measurement of independent sample t test, the F = 13.537 with 0.001 significance. The value of significance which was lower than 0.05 proves that the variance of post test in the concept understanding of experimental and control group is uneven; thus, the t coefficient value should be appeared in t column of equal variance not assumed line.

The background of decision making in this test can be done based on the probability value (p), if probability p (sig (2-tailed))>0.05 so H_0 is accepted and if the probability p (sig (2-tailed)) < 0.05 so H_0 is rejected. Based on table 2, the resulted t value was 0.699 with p (sig (2-tailed)) 0.489. Because p (sig (2-tailed))>0.05 therefore, H_0 was accepted. Therefore, it can be stated that there is no significant difference between students who got physics concept using POE (Prediction, Observation, and Explanation) with experimental and demonstration method. Based on the statistics, the average value of students using experimental was 6.65 while the class which used demonstration was 8.33.

This research is aimed to discover the difference of physics concepts understanding between learning process using POE (Prediction, Observation, and Explanation) with experimental or demonstration model. The difference of experimental and demonstration class was located on the difference of method used.

The difference of method applied in the experimental and control class makes the goal of students' activities different. The experimental group with POE and experimental method tend to understand the concepts of physics in three important steps, such as prediction, observation, and explaining the observation result with matching it to the prediction. Meanwhile, the control group tends to understand concepts of physics through demonstration and lecturing in class with the companion of POE steps.

During the initial part of the research, it was predicted in the hypothesis that there will be a significant difference between students following class with POE and experiment or demonstration. These things are based on several considerations, such as:

1. Learning process with POE tries to combine tree main skills of scientific approaches, including making prediction, doing observation, and explaining. Explanation part was done by matching the observation result with students' prediction. In the end, the students will find the real concept of physics materials learned.
2. Learning process with POE model provides students more experiences to discover the concepts of physics. Experience makes students more understand about physics concepts.
3. The concept of physics will be easily understood if it is related to concrete familiar physics things. Through POE, the students were invited to observe by themselves simple physics activities around them. If these meaningful concepts were given to the students with logical concepts, the thing will be more easily to be remembered by the students. Therefore, students understanding to certain concepts will increase.

4. POE with experiment gives learning experience which is more than using demonstration.

Based on those four assumptions, there will be different understanding of concepts of physics to students following POE with experiment or demonstration where the learning process with POE-experiment is predicted to improve students understanding of physics more than using POE-demonstration where the students only observed the physics activity through teachers' lecture.

The result of hypothesis examination shows that physics learning using POE combined with experiment was not better than using demonstration. This result proves that the hypothesis proposed by the researcher was not accepted. The possibilities causing the rejection of hypotheses was because the demonstration provides more chance to students in understanding physics through demonstration and teachers' lectures. Through lectures the students have more notes for them to remember. These notes are very important to them in understanding the concept of physics delivered by the teachers. Besides, POE is one of the models rarely used by teachers in school that the application of it is not meeting the prediction of the researcher. Since in the steps of explanation was done ineffectively where the students were only explaining their observation results.

There was no significant difference between POE model combined with experiment and POE model combined with demonstration. Thus, both methods can become teachers' alternative in giving the lesson's materials. But, it is undeniable that not all physics material can be explained through experiment or demonstration, therefore, teachers should be more creative in choosing proper learning method based on the characteristics of physics material.

CONCLUSION

Based on the increase in the average value of pretest and post test, obtained an average value of the experiments class is 6.65, while the larger demonstration class is 8.33. This suggests that physics learning using POE models with experiment methods are worse to improve students physics concept understanding compared using POE models with demonstration methods. It can be concluded that there was no any significant difference in students understanding of physics concepts between students following class with POE (Prediction, Observation, and Explanation) combined with experimental methods and POE combined with demonstration method.

REFERENCES

Adams, N. E. (2015). Bloom's taxonomy of cognitive learning objectives.*Journal of the Medical Library Association : JMLA, 103(3)*, 152–153.

Cortina J. (1993). What is coefficient alpha: an examination of theory and applications? *Journal of applied psychology. 78:98-104.*

Cronbach L. (1951). Coefficient alpha and the internal structure of tests.*Psychomerika. 16:297-334.*

Ma'rifatun, D., Martini, K. S., & Utomo, S. B. (2014). *P*engaruh Model Pembelajaran Predict Observe Explaint (Poe) Menggunakan Metode Eksperimen dan Demonstrasi Terhadap Prestasi Belajar Siswa Pada Pokok Bahasan Larutan Penyangga Kelas Xi Sma *Al Islam 1 Surakarta Tahun Pelajaran 2013/2014. Jurnal Pendidikan Kimia, 3(3)*, 11-16.

Hart, Christina; Mulhall, Pamela; Berry, Amanda; Loughran, John; Gunstone, Richard (2000). What is the Purpose of this Experiment? Or Can Students Learn Something from Doing Experiments?. *Journal of Research in Sciencæ Teaching, v37 n7 p655-75.*

Hofstein, A., & Lunetta, V.N. (1982). The role of the laboratory in science teaching: Neglected aspects of research.*Review of Educational Research, 52, 201 ± 217.*

Kerr, J.F. (1964). Practical work in school science. Leicester: University Press

Kurniawan, A.D. (2011). Metode Innkuiri Terbimbing dalam Pembuatan Media Pembelajaran Biologi untuk Meningkatkan Pemahaman Konsep dan Kreativitas Siswa SMP.*Jurnal Pendidikan MIPA, 3(1), 3-16.*

Mohsen, T. & Dennick, R. (2011). Making sense of Cronbach's alpha.*International Journal of Medical Education. ; 2:53-55.*

Olubu, O. M. (2015). Effects of Laboratory Learning Environment on Student's learning Outcomes in Secondary School. *Chemistry International Journal of Arts & Sciences, 8(2)*, 507.

Ozdemir, H., Bag, Huseyin., & Bilen, K., (2011). Effect of laboratory activities designed based on prediction- observation - explanation (POE) strategy on pre-service science teachers' understanding of acid-base subject

Western Anatolia Journal of Educational Science. 169-174.

Putra, Kristian Adi. (2014). The Implication of Curriculum Renewal on ELT in Indonesia. PAROLE:*Journal of Linguistics and Education, [S.l.]*, p. 63-75.

Restami, M. P., Suma, K., & Pujani, M. (2013). Pengaruh Model Pembelajaran Poe (Predict-Observe-Explaint) Terhadap Pemahaman Konsep Fisika dan Sikap Ilmiah Ditinjau Dari Gaya Belajar Siswa. *Jurnal Pendidikan IPA, 3(1).*

Suparna. (2003). *Pengantar Dasar-dasar Kependidikan*. Surabaya: Usaha Nasional

Tanzila, R., Mahardika, I., & Handayani, R. (2017). Model Pembelajaran Poe (Prediction, Observation, And Explanation) Disertai Teknik Concept Mapping Pada Pembelajaran Fisika Di Sma Negeri 1 Jenggawah.*JURNAL PEMBELAJARAN FISIKA, 5(2)*, 96-102.

Zaman, T. U., Bhatti, R. U., & Ghias, F. (2012). Effectiveness of Pre-labs at Secondary School Level Chemistry Lab. *Pakistan Journal of Science, 64(1).*