THE EFFECTIVENESS OF POE (PREDICT-OBSERVE-EXPLAIN) BASED TEACHING STRATEGY IN IMPROVING STUDENTS' CONCEPTUAL UNDERSTANDING ON HEAT AND TEMPERATURE IN SMAN 9 PALEMBANG

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Abstract

The objective of this research is to determine the effectiveness of POE (Predict-Observe-Explain) based teaching strategy in improving students' conceptual understanding on Heat and temperature in SMAN 09 Palembang. The research was conducted on even semester in Academic Year 2015/2016. The research used the quasi experimental method with non-equivalent control group design. The sample comprising of 80 students was selected by using purposive technique sampling. The learning process in the experimental group used POE (Predict-Observe-Explain) based teaching strategy and in the control group used conventional one. The instruments used are the Thermal Concept Evaluation (TCE) consisting of 20 multiple choice questions to measure student's conceptual understanding and observation sheet to observe the students' activities during the lesson. Based on the data analysis using Z-test on significance (α) = 0.05, it was found that Z_{count}= 4.16 and Z_{tabel}= 1.645 showed $Z_{count} > Z_{tabel}$. The result was H_o was rejected and H_a was accepted. The conclusion is the POE (Predict-Observe-Explain) based teaching strategy was effective to improve learners' conceptual understanding on Heat and temperature topics.

Keywords: *POE, Conceptual Understanding, Heat, Temperature.*

1. Introduction

One of aim from physics subject are student capable to understanding the concepts and physics's principle and also have a skill to develop their knowledge as a stocks to continue to higher education (Depdiknas, 2006). From physics aim's explanation show that student's consept understanding become an important key to reach the aim itself.

Conventional learning model in one class will making a passif class and meaningless. It can be happen because the student do not have a chance to express their ideas or doing a demonstration. Then, it will block concept understanding's student.

Ndraka (in Wirtha and Rapi, 2007) explain, concept understanding in learning process should preparing the students to higher education. Moreover, preparing the students for: 1) capable to solving the problem with saintific concepts, 2) capable to taking a appropriate decision with saintific concepts, and 3) having saintific attitude to solving the problem which making them to thingking and acting saintificly.

A lot of researcher have been researched about concept understanding that low in some subjects. One of them is heat and temperature. The result, heat is not energy, heat and temperature are something same, heat can not measured, human body in cold situation is not contain heat, temperature can be transferred, temperature is special characteristic which haved a matter or things, water can not reach in temperature 0°C (Sirait, 2009).

Researcher had an interview with teacher in SMAN 09 Palembang. In there, teacher teachs with talk method. To raise the concept understanding, teacher need to staking a strategy. One of factor which being guarantee to make conceptual change happen according to Posner on Syuhendri (2010) concept that wiil be substitute must on status dissatisfied and the substitute concept must plausible, intelligible, dan fruitful.

Developing Science concept understanding can do with develop a special strategy in learning process. Predict-Observe-Explain (POE) base teaching strategy is one of teaching strategy that can develop the students' concept understanding. Base on the background, researcher want to research about effectiveness of POE (Predict-Observe-Explain) based teaching strategy in improving students' conceptual understanding on Heat and temperature in SMAN 09 Palembang.

2. Theoretical Background

The effectiveness's word come from effective means there's an effect (influence, consequence, impression), powerfull, effective (Purwadarminta, 1986). Base on Indonesian big dictionary effective's word means having an effect,consequence, and can bring a result. Then, we can conclude that effectiveness

is an event that show how far our planning could reach. If there's so many decision success, it means the learning process more effective.

Base on Depdiknas on Suryono (2012) in learning physics, first demanded to capable to understanding the concept, principal, laws, then students can rearrange using their own language base on their intellectual development. Physics is branch of science that learning and giving quantitative understanding for some indication or natural process and matter characteristic and the application (Mundilarto, 2013).

Rosser in Dahar (2011) declare that concept is an abstraction that representative a whole objects class, events, activities, and relations which having same attributes. Someone's description about one concept according to expert called conception (Nakhleh in Talakua, 2013). Beside that, misconception is one of terminology to explain that something that we understand is different with expert's understanding, or someone's conception is different or contradiction with scientist's conception (Syuhendri, 2010).

Piaget (In Syuhendri, 2010) look the Conceptual Change Model process start from assimilation process and then accommodation. According to Piaget, assimilation happen because the students's early knowledge linier with the phenomenon and there's no scheme change or conceptual change (Posner et al., 1982). Meanwhile, Posner et al., (1982) has a larger point of view where aacomodation is conceptual change process because student's concept is not suitable with the new phenomenon: different context. According to Posner (In Syuhendri, 2010) there are four condition to make conceptual change in students through accommodation process, they are :

1. There's dissatisfaction for concept which already exist. Student will change their concept if their feel the old concept can not be using to response new phenomenon and experience.
2. The new concept must intelligible, rational and can solve the problem or new phenomenon.
3. The new concept must plausible, can solve the old problem and consistent with some teories or the knowledge that already exist.
4. The new concept must fruitful on developing the research or new discovery.

There are two things that have a relation about how this accomodation happen, 1) in what situation this accomodation can happen, and 2) concept ecology. As we know, there are five conditions to make conceptual change. Beside that, connecting with concept ecology, Posne et al explain that there are five concept ecology, 1) Anomali, 2) Analogy and Metaform, 3) Epistemology commitment, 4) Believe and metaphysics concept 5) Another knowledge (Syuhendri, 2014).

There's so many teaching strategy that developed for conceptual change. Scott et al., (In Syuhendri, 2010) divide two groups conceptual change. base on teaching strategy : 1) kognisi conflict base strategi, and 2) students's early concept base strategy.

Prediction, Observation and Explanation is one of teaching strategy that started with giving a problem to students then the students asked to guess or making a prediction, then continue to doing observation about the case to find the truth or fact from the early prediction according to explanation (Indrawati and Setiawan, 2009). Predict-Observe-Explain introduced by White and Gusnstone in 1995 on their book namely Probing Understanding. Strategi pembelajaran Predict-Observe-Explain merupakan langkah yang efisien untuk menciptakan diskusi para siswa mengenai konsep ilmu pengetahuan.

The characteristic of Prediction, Observation and Explanation based teaching strategy is digging students's science consept understanding by three steps, according to Indrawati and Setiawan (2009) :

1. Predict is one of prosess that making a guess or prediction about some phenomenon. Students predict the answer of problem that giving by the teacher, then students write the prediction with the reason. Students arrange the prediction base on their knowledge

2. Observe is one of process that students doing an observation. Students observe directly or indirectly. Students record what they observe, then related their prediction with what they get form observation.

3. Explainis one of process of students that giving an explanation about relation about prediction and observation result.
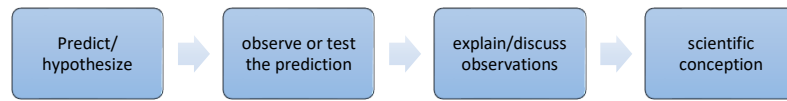
Figure 1 POE base teaching strategy (Tlala, 2011)

Prediction, Observation and Explanation based teaching strategy is one of conceptual change domain. Four conditions according to cognisi development teory (Piaget) to make conceptual change happen should present in teaching processs.
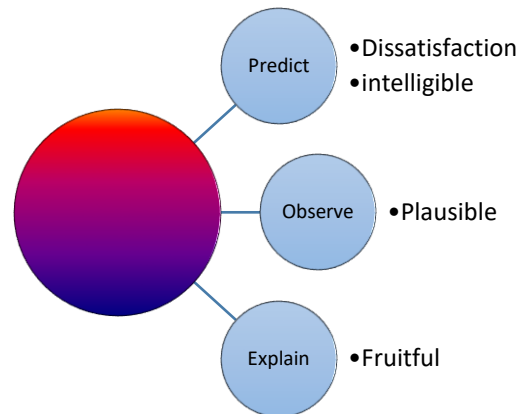

Figure 2 Relation POE Teahing Process with Four Condition Conceptual change.

3. Method

This research was conducted in senior high school 09 Palembang. This research was quasi experimental with non equivalent control group design. The class divided two class which is experimental and control class.

instrument used thermal concept evaluation and student work sheets on every learning process. Observation in this study used to see student and teacher activities. The observer of this researcher was physics teacher and researcher itself.

Data analyze technique using N-gain and Z-test. According to Hake (1999) Gain normaliz tion could describe improvement learners's concept understanding. The normalized gain (N-gain) was calculated by using the following equation:

$$\% \, N - Gain = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}} x100\%$$

(Hake, 1999)

To know the meaning of N-gain values whether they belonged to high, medium or low

categories, a criteria proposed was used.

Table 1 N-Gain Criteria

N-Gain <g>	criteria
(<g>) > 0,7	High
0,3 ≤ (<g>) ≤ 0,7	middle
<g> < 0,3	Low

Beside analyzed N-Gain, data analyze pre-condition testing should do to know wether hypotheses existing in this study will accepted or rejected (Stalin, 2012.) Data analyze pre-condition testing using normalization test, Homogenity test, as a requirements to use Z-test parametic statistic. Z-test used because the sample consist more than 30 students uji Z digunakan (Gunawan, 2005). If standard deviation exist, the formula used:

$$Z = \frac{\bar{x}_1 - \bar{x}_2}{s\,\bar{x}_1 - \bar{x}_2}$$

(Gunawan, 2015)

Which,

$$S\,\bar{x}_1 - \bar{x}_2 = \sqrt{(S_1^2 / n_1) + (S_2^2 / n_2)}$$

Information :

s_1^2 and s_2^2 = varians values group 1 dan group 2

$\bar{x}_1$ and $\bar{x}_2$ = group 1 dan group 2 average

n_1 and n_2 = students

Testing criteria are accepted H_0 if $Z_{count} < Z_{table}$, otherwise H_0 be rejected if $Z_{count} > Z_{table,}$.

4. Result and Discussion

The study was carried out for five weeks, starting 09 February, 2016. Two weeks used for pre-test and post-test. Three weeks used for learning activities. In the next session, it would explain about students and teacher activities in the experiment and control class.

4.1. Description of Learning Process

Learning process in this research held three times, the topic is heat and temperature. Learning time was suitable with KTSP syllabus. The objective in every learning process attached on learning process planning. Learning process in experiment class held on every thursday using Predict observe explain based teaching. Learning process in the control class held on every Friday using conventional teaching model.

4.2. Description and Discussion of Findings

Based on the analysis orf pre-test and post-test data, the researcher found N-gain values from experiment class and control class. As shown in tabel 2,

Table 2 Pre-test, Post-test, and N-gain Values average

Information	Pre-test Data		Post-test Data		N-Gain Values	
	Experiment Class	Control Class	Experiment Class	Control Class	Experiment Class	Control Class
Highest values	55	55	95	85	0,92	0,8
Lowest values	15	15	60	40	0,33	0,21
Average	31,87	31,75	76	64,25	0,63	0,47

Based on table 1, in pre-test experiment class and control class almost had same scores, it showed that they came from same condition. The average score of pre-test increased from 31,87 become 76 in experiment class. In control class The score of pre-test increased from 31,75 become 64,25. From that scores, we got the average of N-gain values 0,63 and 0,47.

After researchers got N-gain values, researchers found normalization test, Homogeneity test, and hypotheses test to answer our researchers's hypotheses. Based on analyze, the data from both of class was normal and homogeny. The hypotheses testing showed on table 3.

Table 3 Hypothese test using N-gain values average

Z_{count}	Z_{table}	ioninformat
4,16	1,645	H_a accepted

Hypotheses test used significance level $(\alpha) = 5\%$. From table 4.2 showed that Z_{count} bigger than Z_{table} which $4,16 > 1,645$. Because $Z_{count} > Z_{table}$ The result was H_o be rejected and H_a accepted. So we can conclude that the POE (Predict-Observe-Explain) based teaching strategy was effective to improve learners' conceptual understanding on Heat and temperature topics.

4.3. Observation Data Analyze

Observation divide two activities in experiment class, they are teacher activities and student activities. Teacher activities observed by colleague and physics teacher.student activities observed by researcher. The student activities will show in figure 3.
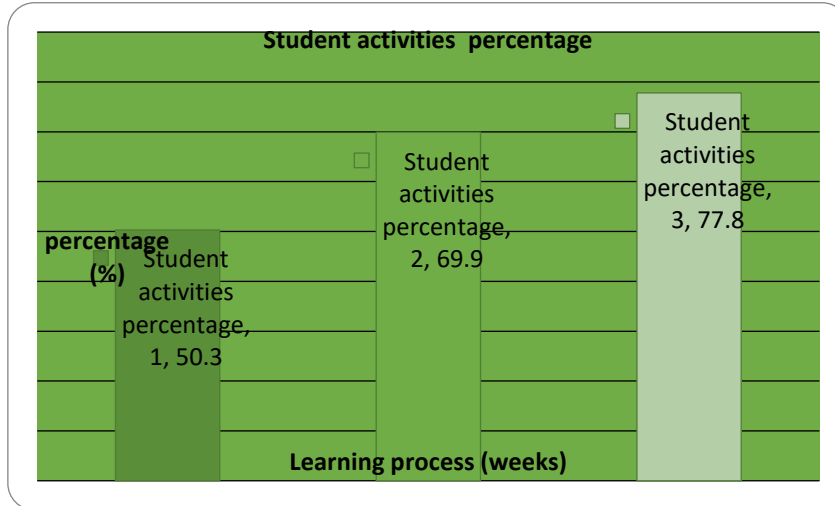

Figure 3 Student activities percentage

Based on figure 1 showed percentage observation of student activities in learning process. Each class having 40 students. In experiment class, students divided eight groups which consist of fives students. In the first meeting, the percentage was 50,3 %. In the next meeting, the percentage was 69,9%. And the last meeting the percentage reached 77,8%..

5. Conclusions

Based on the analysis above, it can be concluded that (1) POE (Predict-Observe-Explain) based teaching strategy was effective to improve learners' conceptual understanding on Heat and temperature topics, and (2) POE (Predict-Observe-Explain) based teaching strategy could raise the student activities in class.

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