IMPROVING CRITICAL THINKING SKILL AND SCIENTIFIC BEHAVIOR THROUGH THE IMPLEMENTATION OF PREDICT OBSERVE EXPLAIN LEARNING MODEL

Muhibbuddin[1*], Suhrawardi Ilyas[2], Cut Eka Para Samya[3]

[1]Dr., Universitas Syiah Kuala, Banda Aceh, Indonesia, muhib.bio@gmail.com
[2]Dr., Universitas Syiah Kuala, Banda Aceh, Indonesia, suhra2020@gmail.com
[3]Universitas Syiah Kuala, Banda Aceh, Indonesia, cuteka.parasamya@gmail.com
[*]Corresponding Author

Abstract

Critical thinking skills and scientific behaviors are important abilities that must be mastered and possessed by students in solving problems. The problem which frequently faced by students is they have been able to comprehend the science but have not been able to provide conclusions logically and systematically. The phenomenon shows the low critical thinking skills and scientific behaviors of students. To overcome these problems, it needs a change in the process of delivering learning material to students. This research aims to answer the question of whether learning through the implementation of the predict observe explain model has an effect on improving student critical thinking skills and scientific behaviors. The method used in this research is an experimental design pretest posttest control group. The parameters measured were critical thinking skills and scientific behaviors. Improvement of critical thinking skills and scientific behaviors was measured by calculating gain normalization (n-gain). The instruments used were the observation sheet and objective tests with five alternative answers. Data collection is done through pretest, posttest and observation during the learning process. Analysis of critical thinking skills was done by comparing the initial ability with the final ability of students and tested the significance of the two different tests on average using independent simple t-test. The results of the study indicated that the initial ability of thinking skills between the experimental and control classes did not have a significant difference, while the final ability showed significantly different results. Based on these results, it can be concluded that the implementation of the the predict observe explain model contribute in student critical thinking skills and scientific attitudes.

Keywords: predict observe explain, critical thinking, scientific behavior.

1. INTRODUCTION

Learning of science in schools, especially physics subject is a concentration that is closely related to finding out about natural symptoms systematically (Zubaidah, 2011). Physics is a science that was born and developed through scientific steps including observation, formulating problems, composing hypotheses, conducting experiments, drawing conclusions and proving theories and concepts (Hapsari et al., 2017). Problems that occur at this time, in the process of learning physics often the teacher becomes the center of learning (teacher centered) and students only become the object of the recipient (Antika, 2014). The observations made by Wiyanto et al. (2006) showed that physics learning tends to be monotonous, the activities that the teacher is most dominant in are lecturing or explaining while for students is listening and taking notes. Besides that, the use of learning systems now students are only given knowledge by imagining without experiencing it themselves, even though physics subjects between concepts and the surrounding environment are very closely related (Setyowati et al., 2011). As stated by Restami et al. (2013), that physics learning still tends to be memorized based on theory not based on students 'direct experience, so students' ability to understand concepts is still very low. Such learning processes are difficult to develop students' critical thinking skills and scientific attitudes.

Data from interviews and observations with physics teachers at one of the high schools in the city of Banda Aceh found that students have not been able to apply critical thinking skills in solving problems they face, so they have difficulty in solving the problems given. Students are still less active in the learning process so that they are not successful in cultivating a scientific attitude, thus influencing the low results of student physics learning. Student learning outcomes are evaluated using tests, one of which is the national exam (UN). Among the UN physics material, one of the lowest achievements is in thermodynamic law material. The low value obtained is also seen from the student test value data. Data obtained from the repetition value of one class illustrates that of the 32 students only 10 students whose values reached the minimum completeness criteria (KKM), while the other 22 had not yet reached the KKM value as expected.

The process of delivering learning material to students can be selected by several learning models (Rahayu, 2015; Wijanarko, 2017), predict observe explain model is one alternative that can be used by teachers to create an interactive, interesting, and fun learning atmosphere (Ma'rifatun et al., 2014). Learning model predict observe explain can spur students' thinking skills to express predictions about a problem that arises in the community and can spur students to prove their predictions by direct investigation (Wahyuni et al., 2015). Learning by using the predict observe explain model is effective in improving students' critical thinking skills (Mulyani et al., 2017) through three stages, namely predicting things that happen, proving predictions through observation and giving an explanation of the predictions and observations that have been made (Rahmah & Kusasi, 2016). Nurmalasari et al. (2016), states that by using the learning model predict observe explain, students' critical thinking skills can be improved. Based on research by Restami et al. (2013), students' scientific attitudes can also be improved by using the learning model predict observe explain.

There are several reasons that the learning model predict observe is used in an effort to teach physics material to students. The learning model predict observe explain has the advantages of conventional methods, namely the learning process becomes more interesting, because students not only listen but also observe events that occur through experiments (Yuliasih et al., 2017). Learning using the predict observe explain model is not teacher-centered but rather to students (Farikha et al., 2015). Students can compare the knowledge and experience gained based on the theories they read with the facts or facts they find in everyday life (Ayvaci, 2013).

The predict observe explain model has been widely applied to science subjects namely on biology subjects (Qomariyah et al., 2014; Megayani & Nurhalimah, 2017), chemistry subjects (Anisa et al., 2013; Ma'rifatun et al., 2014; Farikha et al., 2015; Rahmah & Kusasi, 2016; Setiawan et al., 2017) and on physics subjects (Tyas et al., 2013; Rosdianto et al., 2017). Identified explain explain models can improve critical thinking skills and learning outcomes (Rahmah & Kusasi, 2016; Setiawan et al., 2017), ability to think creatively (Qomariyah et al., 2014; Indriana et al., 2015), and concepts of understanding (Rosdianto et al., 2017), and can improve student misconception (Tyas et al., 2013). Learning by applying the predict observe explain model is more effective in improving learning outcomes (Megayani & Nurhalimah, 2017) and student learning achievement (Anisa et al., 2013; Ma’rifatun et al., 2014; Farikha et al., 2015). The results of the study only observed an increase in critical thinking skills using a model of predict observe explain on chemistry subjects. Whereas the studies that observed the improvement of critical thinking skills and scientific attitudes using the predict observe explain model on physics learning were still very limited. Therefore, this study was conducted, to find out whether the application of the predict observe explain learning model is able to improve critical thinking skills and develop students' scientific attitudes to physics subjects.

2. RESEARCH METHOD

This research uses a quantitative approach with the type of applied research. The method used in this research is the experimental method with the design of the pretest posttest control group (Gall *et al*., 2003). The research design is shown in Table 1.

Table 1. Pretest Posttest Control Group Design

Sample	Groups	Pretest	Treatment	Posttest
Random	Experiment	O^1	X1	O^2
Random	Control	O^1	X2	O^2

X_1 = Learning using the predict observe explain model.
X_2 = Learning using Convensional method.
O^1 = Pretest
O^2 = Posttest

The population in this research was all students of class XI IPA in one of the high schools in Banda Aceh City. The sampling technique in this study was random. The sample in this study consisted of 64 students divided into two classes, each of which amounted to 32 students. The research was conducted for 28 days which began in February and was completed in March 2019. The study was conducted in three steps. First, evaluate the students' initial skills. At this stage students are asked to answer 10 reasoned multiple choice questions related to physics. Data obtained from this step are used as preliminary knowledge data before applying the learning model predict observe explain. Second, apply the learning model predict Observe explain based on the following steps (1). predicting, guessing about an event, (2) observing, temporary allegations given by students must be proven by conducting experiments, (3) making explanations, students summarizing the findings and then describing or explaining more fully. Third, a final evaluation is carried out after the learning process. The final evaluation was conducted to find out the final ability of students after the learning process using the model predict observe explain.

3. DATA AND ANALYSIS

The parameters measured are critical thinking skills and scientific attitudes. The test used in the form of reasoned multiple choice tests as many as 10 questions, while for non-test assessment using the observation sheet. Tests of critical thinking skills are arranged based on eight functions of critical thinking skills according to Inch (Susanti, 2014) and explored based on the pretest and posttest answers given at the beginning and at the end of the learning process. The data obtained were analyzed by comparing students' initial abilities and final abilities and tested their significance through two different tests on average using independent simple t-test. To measure aspects of critical thinking skills and scientific attitude is done by calculating the percentage increase in the average of each aspect and indicator observed during the learning process.

4. FINDINGS AND DISCUSSION

Comparison of the achievement of the mean scores of pretest, posttest and n-Gain between the experimental class and the control class is shown in Figure 1.

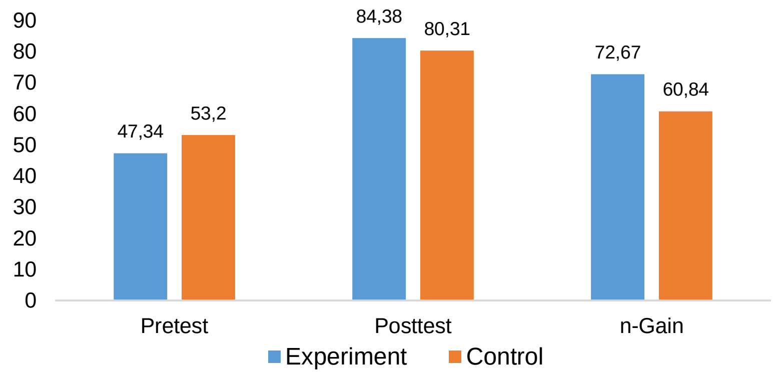

Figure 1. Comparison of Pretest Scores, Posttest and n-Gain Experiment Classes and Control Classes

Based on Figure 1 it can be seen that there was an increase in the score of critical thinking skills in the experimental class and the control class, as seen from the pretest and n-Gain scores of each class. The average experimental class pretest score was 47.34 and the control class average score was 53.20, whereas the experimental class n-Gain score was 72.67 and for the control class 60.84.

The results of the two different tests the average critical thinking skills between the experimental class and the control class showed no significant differences. This shows that the initial ability of the experimental class and the control class are the same. Furthermore, after the application of predict observe explain, the increase in the average score of n-Gain on students' critical thinking skills, there is a significant difference. Data obtained from this study indicate that the model predict observe explain is effective in improving students' critical thinking skills. The data in full is shown in Table 2.

Table 2. Differences in the Average Pretest Score of Critical Thinking Skills

Score	Classes	Average score	Normality*	Homogeneity**	Significance***
Pretest	Experiment	47,34	$X^2_{count} < X^2_{table}$ (4.76) < (7.81) (Normal)	$F_{count} < F_{table}$ (1.47) < (1.84) (Homogeneous)	$t_{count} < t_{table}$ (-2.596) < (1.68) (Not significantly different)
	Control	53,20	$X^2_{count} < X^2_{table}$ (0.57) < (7.81) (Normal)		
N-Gain	Experiment	72,67	$X^2_{count} < X^2_{table}$ (6.85) < (7.81) (Normal)	$F_{count} < F_{table}$ (1.68) < (1.84) (Homogeneous)	$t_{count} < t_{table}$ (5.686) < (1.68) (Significantly different)
	Control	60,84	$X^2_{count} < X^2_{table}$ (4.91) < (7.81) (Normal)		

Description:
*) = Chi square test (normal, $X^2_{count} < X^2_{table}$, α= 0,05)
**) = F-Test (Homogeneous, $F_{count} < F_{table}$, , α= 0,05)
***) = t-Test (significantly, $t_{count} < t_{table}$, α= 0,05)

The aspects of critical thinking skills observed in this study consisted of six aspects, namely: interpretation, explain, analysis, inference, evaluation, and self-regulation. The average increase in each aspect is obtained through direct observation during the learning process. Comparison of the percentage of the average aspects of critical thinking skills in each class can be seen in Figure 2.

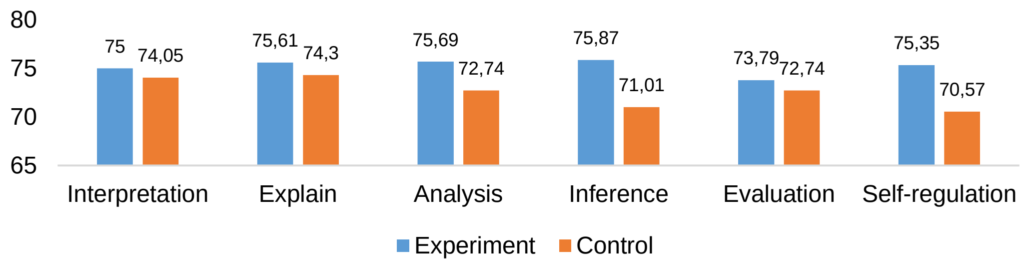

Figure 2. Comparison of the Average Percentage Critical Thinking Skills Aspects in Experimental Classes and Control Classes

Based on Figure 2 it can be seen that the average percentage of aspects of critical thinking skills of the experimental class students is higher than the control class and categorized as high. This proves that through the application of the model predict observe explain students are trained to master every aspect of critical thinking skills. Solving physics problems requires high thinking skills, because not all physics problems can be solved by applying all known variables into physical equations. Students must first analyze the variables in the problem and determine the direction of the problems given, so that they can be resolved correctly (Winarti, 2015).

Analysis of improving scientific attitudes is done by calculating percentages on each indicator of scientific attitude. Indicators of scientific attitudes observed through this study consisted of six indicators, namely: curiosity, honesty, cooperation, thoroughness, responsibility and critical attitude. The average increase in each indicator is obtained through direct observation during the learning process. Comparison of the percentage of the average scientific attitude indicator in each class can be seen in Figure 3.

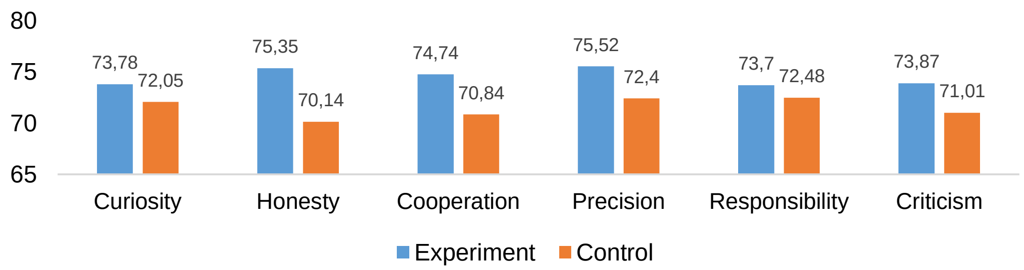

Figure 3. Comparison of the Average Scientific Attitude Indicators of Experimental Classes and Control Classes

Based on Figure 3 it can be seen that the average percentage of scientific attitude indicators of experimental class students is higher than the control class. After analysis, it was found that the scientific attitude of the students both the experimental class and the control class was in the high category. This is because the predict observe explain model requires students to be able to find out and prove allegations based on their findings.

5. CONCLUSION

Based on the results of the research and data analysis, it was found that there were significant differences between the pretest and n-Gain scores of the experimental and control classes. Then it can be concluded that the critical thinking skills and scientific attitudes of students who were treated using the predict observe explain model were better than those students who were treated using conventional models.

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