JIPF (JURNAL ILMU PENDIDIKAN FISIKA)
p-ISSN: 2477-5959 | e-ISSN: 2477-8451 *Vol. 6 No. 3, September 2021, Page 228-233*

The Effectiveness of Predict Observe Explain Learning Model to Students' Critical Thinking Skills

Cut Eka Para Samya [1], Muhibbuddin [2], Suhrawardi Ilyas [3]
Universitas Syiah Kuala, Indonesia[1,2,3]
cuteka.parasamya@gmail.com[1], muhib.bio@gmail.com[2], suhra2020@gmail.com[3]

Received: January 31st, 2021. Revised: May 3rd, 2021. Accepted: May 19th, 2021

Keywords :
Predict Observe Explain Learning Model; Critical Thinking Skill; Effectiveness

ABSTRACT
This research aims to understand the differences of critical thinking skill in learning physics using predict observe explain (POE). It was experimental research with pretest posttest control group. It was conducted in class XI IPA of SMAN 3 Banda Aceh on the topic of thermodynamic law. This research used two parallel classes, which is the first class stands for control and another is used as experiment. Conventional model is applied in control class, whereas class of experiment had predict observe explain model. Instrument of this research was objective test with five multiple choice. Then, data were collected through pretest and posttest. Data analysis is carried out by comparing initial and final skills of students and then tested for significance using two different means through independent simple t-test. The results showed that there were differences in critical thinking skills between students using POE model and students using non-POE model. Therefore, it can be concluded that application of learning model predict observe explain in improving students critical thinking skills.

INTRODUCTION

Science learning has huge potency and strategy to prepare the good quality of human resource among globalization. The potencies will exist when science learning can produce students who are capable in their fields and succeed in developing thinking skills, problem-solving skills, and scientific behavior [1]. One of the science learning which underlies advanced technology development and the concept of living in harmony with nature is physics [2].

Physics learning must be studied by students at school, known as the difficult and less preferred subject because of its relation to experiments, formulas, calculation, graphics, and concept explanation at the same time [3]. To learn physics, students are required to develop higher-order thinking skills [4]].

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. In addition,

with the use of the current learning system students are only given knowledge through lectures in an abstract manner without experiencing it themselves, even though physics subjects are closely related to the concept and the environment. In fact at this time, physics learning still tends to be based on memorizing theory and is not based on the direct experience of students, so that the ability of students to relate concepts to events is still very low [5]. Such a learning process is difficult to develop critical thinking skills.

Critical thinking skills are needed in analyzing a problem [6]. Critical thinking skills must be developed in students according to the development of their thinking [7]. The habit of critical thinking has not been traditionalized in schools. Few schools teach students to think critically, teachers encourage students to give correct answers rather than encourage students to come up with their ideas [8]. The critical thinking process requires students to be able to observe problems that exist in physics [9], be able to solve all physics problems appropriately and be able to apply them in everyday life. By developing critical thinking skills, it is hoped that students will take part in learning activities so that it has a positive impact and can change the paradigm that physics is difficult to become fun physics.

Several possible causes of the difficulty of developing students' critical thinking skills in physics subjects resulting in low-class average scores include (1) the topic of the law of thermodynamics is a learning topic containing many difficult physics concepts; (2) the learning model used is still not sufficient to facilitate the development of students' critical thinking skills.

According to data interviews and observation with physics teachers at SMAN 3 Banda Aceh, it found that students had not been able to apply critical thinking skills regarding their problems, therefore they did not solve the problems easily. Students are still less active in the learning process, so they do not succeed in developing critical thinking skills, thus affecting low outcomes in the learning of physics. Students' learning outcome is evaluated using a daily test. Data obtained from that evaluation showed that 9 out of 32 students reached the minimum score of completeness criteria. Based on this, there needs to be a change in the delivery of learning material in schools. The process of delivering learning material to students can be selected from various appropriate learning models. One alternative learning model that can be used is the Predict Observe Explain (POE) model.

POE model can be used to either discover student ideas or thinking skills to explore concept knowledge. Besides that, it is used to trigger students for investigation [10]. In addition, they can test and complete the explanation, or doing a modification [11]. This effective POE model has three steps to improve student's critical thinking skills, namely predicting things that will happen, proving the prediction through observation and explaining what has been predicted and observed [12].

The POE model is known to improve student analytical skills [13], creative thinking skills [14], science process skills [15], and comprehension of concepts [16] [17] [18] [19] [20], and can reduce student misconception [21]. Learning by applied POE model is more effective to increase student learning outcomes [22] [23] and student learning achievements [24] [25]. Several previous research using POE model were conducted in chemistry subject, meanwhile in physics learning is still very limited. Therefore, this research was conducted to find out whether the application of the learning model predict observe explain is effective in improving students' critical thinking skills on the topic of thermodynamic law.

METHOD

The research used experimental method with a pretest posttest control group design. It was conducted in class XI IPA SMAN 3 Banda Aceh on the topic of thermodynamic law. The sample was elected using random sampling technique. The sample in this research consisted of 64 students who were divided into two classes, each has 32 students. The instrument used was reasoning multiple choice test with 10 questions consisted of alternative answers. The critical thinking skills test is prepared based on the eight functions of critical thinking skills. Data collection was done through pretest and posttest.

Data analysis was carried out by comparing the scores of students' pretest and posttest and tested for significance by means of two different tests using independent simple t-test.

RESULTS AND DISCUSSIONS

Data of critical thinking skills obtained were the analyzed using statistical test. The test is used to indicate the improvement of students' critical thinking skill regarding to the treatments given in learning process. The data analysis shows that pretest and N-gain were normally and homogenous distributed, thus it can be continued for hypothesis test using t-test. The result of data analysis is shown in Table 1.

Table 1. Critical Thinking Skills Data Analysis

Score	Classes	Average	Normality*	Homogeneity**	Significance***
Pretest	Experiment	50.00	$X^2_{count} < X^2_{table}$ (2.97) < (7.81) (Normal)	$F_{count} < F_{table}$ (1.70) < (1.84) (Homogenous)	$t_{count} < t_{table}$ (-0.78) < (1.68) (Not significantly different)
	Control	53.05	$X^2_{count} < X^2_{table}$ (1.05) < (7.81) (Normal)		
N-Gain	Experiment	79.55	$X^2_{count} < X^2_{table}$ (1.97) < (7.81) (Normal)	$F_{count} < F_{table}$ (1.23) < (1.84) (Homogenous)	$t_{count} > t_{table}$ (2,74) > (1,68) (Significantly different)
	Control	71.18	$X^2_{count} < X^2_{table}$ (1.28) < (7.81) (Normal)		

Information:
*) = Chi square test (normal, if the values of $X^2_{count} < X^2_{table}$, α= 0,05)
**) = F-test (homogenous, if the values of $F_{count} < F_{table}$, α= 0,05)
***) = t-test (significant, if the values of $t_{hit} < t_{tab,}$, α= 0,05)

Table 1 confirmed that the normality test of pretest and N gain for both experiment and control have normal distribution. This normality test was analyzed using chi square test under the condition of normal distribution when $X^2_{count} < X^2_{table}$. After that, homogeneity test was analyzed using F-test with provision of $F_{count} < F_{table}$, so the data will be homogenous. Table 1 also informed that either experiment or control class have homogenous N-gain and pretest data. This test was carried out to understand the data of sample came from the same variant population.

Data analysis for students obtained was normally and homogenous distributed, so the test was then continued by t-test using independent sample test. The test was conducted to indicate the difference of average pretest score and N-gain through POE model application on topic of thermodynamic law. Table 1 showed that means of two different test of pretest of class control and experiment was not significantly different. In other words, both class of experiment and control have the same skills. But, after treatment, there were an improvement average score N gain with significant difference. The results confirmed that student performance of experiment class is better than control class, so the hypothesis is accepted.

Data analysis of student critical thinking skills was obtained through pretest and posttest. The results showed that the score had improved both for class of experiment and control. The comparison average scores of pretest, posttest, and N-gain between experiment and control class is shown in Figure 1.

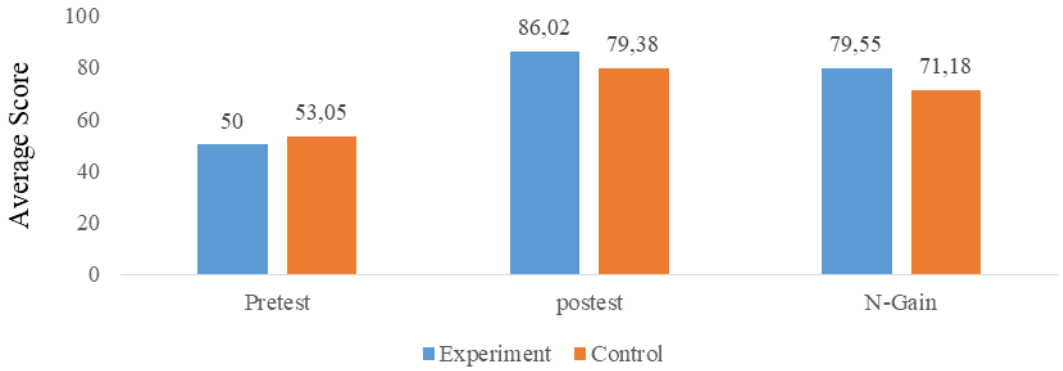

Fig 1. *Comparison average scores of pretest, posttest, and N-gain*

Based on Figure 1 that obtained from reasoning multiple choice questions test, initial abilities of students are relatively similar and low with average scores of class experiment and control are 50.00 and 53.05, respectively. This result informed that students' knowledge is still lack on topic of thermodynamic law. The students' initial abilities are the starting point for further learning. The initial ability of students who are still lacking is certainly a separate obstacle in the subsequent learning process. Initial ability has a contribution to mastery of a material. The students said that their initial knowledge about learning physics was still lacking, especially in terms of the laws of thermodynamics.

After class of experiment was taught using POE model, the average score has increased up to 86.02 with N-gain score of 79.55 (high category), whereas control class which taught using non-POE model reached average score of 79.38 and N-gain of 71.18 (high category). It shown that learning with POE model is accepted students in experiment class regarding to better result compared to control class.

The steps of POE model is better at improving student critical thinking skills, because of its complexity, students are required to be more active during learning process, so they will not be bored and comprehend the thermodynamic law easily. This topic is one of calculation and comprehension topics, thus this POE model can be used as one alternative for problem solving. In addition, this POE model is used as a proper option to improve student critical thinking skills [26].

Despite the strength of POE model, this model also has the weakness, especially when students tried to understand the questions test, because they usually gain many information from teachers when taught using non-POE model. To reduce the problems, there are several guidelines completed by (1) giving the problems related to student daily life, (2) giving opportunity for students to prove their formulating hypothesis, so they have more spirit and active in learning process.

The POE model has various strength, such as able to be used to indicate student ideas and opinions [27] [28], to raise student activity during discussion [13], to motivate students in conceptual learning [29], to ease teachers in understanding students' thinking [30], to improve evaluation and analysis skills [6], to show students' curiosity in investigating [28], to increase student understanding [17], and to improve activity and give chance for students in order to apply their knowledge [24].

CONCLUSION AND SUGGESTION

According to result and data analysis, it confirmed that there is significant difference of pretest and N-gain between class of experiment and control. Therefore, it can be concluded that predict observe explain model is effectively applied to improve student critical thinking skills.

ACKNOWLEDGMENTS

Authors wishing to thank to headmaster of SMAN 3 Banda Aceh who gave the research permit. In addition, thank also to several parties who have taken the time to provide guidance, criticism and suggestions and review this article, so that it is worth to publish..

REFERENCES

[1] Astuti, R., Sunarno, W., & Sudarisman, S. Pembelajaran IPA dengan Pendekatan Ketrampilan Proses Sains Menggunakan Metode Eksperimen Bebas Termodifikasi dan Eksperimen Terbimbing Ditinjau dari Sikap Ilmiah dan Motivasi Belajar Siswa. In *Seminar Nasional XIII Pendidikan Biologi FKIP UNS 2016*. Sebelas Maret University.

[2] Asih, D. A. S. (2017). Pengaruh penggunaan fasilitas belajar di lingkungan alam sekitar terhadap keterampilan proses sains. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *7*(1).

[3] Astalini, A., Kurniawan, D. A., Perdana, R., & Pathoni, H. (2019). Identifikasi sikap peserta didik terhadap mata pelajaran fisika di sekolah menengah atas negeri 5 Kota Jambi. *UPEJ Unnes Physics Education Journal*, *8*(1): 34-43.

[4] A'yunina, Q., Sudarti, S., & Subiki, S. (2019). Analisis Keterampilan Berpikir Tingkat Tinggi Dalam Menyelesaikan Soal UN Fisika SMA Pada Materi Medan Magnet Siswa Kelas XII Di SMA Muhammadiyah 3 Jember. *Jurnal Pembelajaran Fisika*, *8*(3): 159-173.

[5] Restami, M. P., & Suma, K. (2013). Pengaruh model pembelajaran POE (Predict-Observe-Explaint) terhadap pemahaman konsep fisika dan sikap ilmiah ditinjau dari gaya belajar siswa. *Jurnal Pendidikan dan Pembelajaran IPA Indonesia*, *3*(1).

[6] Mulyani, R., Saminan, S., & Sulastri, S. (2017). Peningkatan kemampuan berpikir kritis peserta didik melalui implementasi lembar kerja peserta didik berbasis predict observe explain. *Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education)*, *5*(2): 19-24.

[7] Firdaus, F., Kailani, I., Bakar, M. N. B., & Bakry, B. (2015). Developing critical thinking skills of students in mathematics learning. *Journal of Education and Learning*, *9*(3): 226-236.

[8] Syahbana, A. (2012). Peningkatan kemampuan berpikir kritis matematis siswa smp melalui pendekatan contextual teaching and learning. *Edumatica: Jurnal Pendidikan Matematika*, *2*(1): 45-57.

[9] Yulianto, E., Sopyan, A., & Yulianto, A. (2014). Penerapan Model Pembelajaran Poe (Predict-Observe-Explain) Untuk Meningkatkan Kemampuan Berpikir Kritis Dan Kognitif Fisika SMP. *UPEJ Unnes Physics Education Journal*, *3*(3): 1-6.

[10] Indradinata, I. N. S., Wirawan, I. M. A., & Putrama, I. M. (2015). Pengaruh Model Pembelajaran Predict-Observe-Explain (POE) Terhadap Hasil Belajar Simulasi Digital Siswa Kelas X Tata Boga di SMK Negeri 2 Singaraja Tahun Pelajaran 2014/2015. *KARMAPATI (Kumpulan Artikel Mahasiswa Pendidikan Teknik Informatika)*, *4*(4): 311-317.

[11] Rahayu, S., & Widodo, A. T. (2013). Pengembangan Perangkat Pembelajaran Model POE Berbantuan Media "I am a Scientist". *Innovative Journal of Curriculum and Educational Technology*, *2*(1): 128-133.

[12] Rahmah, S., & Kusasi, M. (2016). Meningkatkan Keterampilan Berpikir Kritis dan Hasil Belajar Siswa Menggunakan Strategi Pembelajaran Predict-Observe-Explain (POE) pada Materi Larutan Elektrolit-Nonelektrolit dan Reaksi Reduksi Oksidasi. *Quantum: Jurnal Inovasi Pendidikan Sains*, *7*(1): 39-45.

[13] Sarah, S., Khanif, A., & Saputra, A. T. (2021). The Effectiveness of POE (Predict-Observe-Explain) Learning Model for Improving Student Analytical Skills. *JIPF (Jurnal Ilmu Pendidikan Fisika)*, *6*(1): 23-29.

[14] Indriana, V., Arsyad, N., & Mulbar, U. (2015). Penerapan pendekatan pembelajaran POE (predict-observe-explain) untuk meningkatkan kemampuan berpikir kreatif siswa kelas XI IPA-1 SMAN 22 Makassar. *Daya Matematis: Jurnal Inovasi Pendidikan Matematika*, *3*(1): 51-62.

[15] Gultom, E. C. (2018). Penerapan Model Pembelajaran Predict, Observe, Explain (POE) pada Materi Larutan Elektrolit dan Non Elektrolit untuk Meningkatkan Keterampilan Proses Sains,

Sikap Ilmiah dan Kemampuan Kognitif Siswa. *Quantum: Jurnal Inovasi Pendidikan Sains*, *9*(1): 76-83.

[16] Andriani, R., Muhali, M., & Dewi, C. A. (2017). Pengaruh Model Pembelajaran Poe (Predict-Observe-Explain) Berorientasi Chemoentrepreneurship Terhadap Pemahaman Konsep Siswa Pada Materi Larutan Penyangga. *Hydrogen: Jurnal Kependidikan Kimia*, *5*(2): 94-101.

[17] Rosdianto, H., Murdani, E., & Hendra. (2017). Implementasi Model Pemebelajaran POE (Predict Observe Explain) untuk Meningkatkan Pemahaman Konsep Siswa pada Materi Hukum Newton. Jurnal Pendidikan Fisika, 6(1): 55-57.

[18] Nurkhaliq, N., Bialangi, N., & Salimi, Y. K. (2018). Pengaruh Model Pembelajaran POE (Predictobserve-Explain) terhadap Kemampuan Pemahaman Konsep Larutan Penyangga Siswa SMA Negeri 1 Gorontalo. *Jambura Journal of Educational Chemistry*, *13*(2): 165-169.

[19] Nugraha, D. A., Dimas, A., Cari, C., Suparmi, A., & Sunarno, W. (2019). Meta Analisis Pengaruh Model Pembelajaran POE terhadap Pemahaman Konsep. In *Prosiding SNFA (Seminar Nasional Fisika dan Aplikasinya)* (Vol. 4, pp. 174-179).

[20] Fatimatuzzohrah, S., Jufri, A. W., & Mertha, I. W. (2020). Efektivitas Penerapan Model Pembelajaran POE (Predict-Observe-Explain) Untuk Meningkatkan Penguasaan Konsep IPA. *Jurnal Pijar MIPA*, *15*(4): 351-356.

[21] Latifah, S., Irwandani, I., Saregar, A., Diani, R., Fiani, O., Widayanti, W., & Deta, U. A. (2019, February). How the Predict-Observe-Explain (POE) learning strategy remediates students' misconception on Temperature and Heat materials?. In *Journal of Physics: Conference Series* (Vol. 1171, No. 1, p. 012051). IOP Publishing.

[22] Liputo, A. P. E. C., Ischak, N. I., & Suleman, N. (2018). Pengaruh Model Pembelajaran Predict Observe Explain (POE) terhadap Hasil Belajar Siswa pada Materi Termokimia suatu Penelitian di MAN 1 Kabupaten Gorontalo. *Jambura Journal of Educational Chemistry*, *13*(2): 151-156.

[23] Suranti, M., Yusuf, M., & Payu, C. S. (2018). Pengaruh Penerapan Model Pembelajaran POE (Predict Observe Explain) terhadap Hasil Belajar Siswa Materi Getaran dan Gelombang. *Jambura Journal of Educational Chemistry*, *13*(2): 227-231.

[24] Farikha, L. I., Redjeki, T., & Utomo, S. B. (2015). Penerapan model pembelajaran predict observe explain (POE) disertai eksperimen pada materi pokok hidrolisis garam untuk meningkatkan aktivitas dan prestasi belajar siswa kelas XI MIA 3 SMA Negeri 4 Surakarta tahun pelajaran 2014/2015. *Jurnal Pendidikan Kimia*, *4*(4): 95-102.

[25] Ariyanti, L., Utami, B., & VH, E. S. (2018). Penerapan Model Pembelajaran Predict Observe Explain (POE) Dilengkapi LKS Berbasis Drill and Practice untuk Meningkatkan Keaktifan dan Prestasi Belajar Siswa pada Materi Hidrolisis Garam Kelas XI IPA 3 Semester Genap SMA N 2 Karanganyar. *Jurnal Pendidikan Kimia*, *7*(1): 86-94.

[26] Setiawan, R., Suharto, B., & Iriani, R. (2017). PEnerapan Strategi Pembelajaran POE (Predict-Observe-Explain) Untuk Meningkatkan Hasil Belajar Dan Keterampilan Berpikir Kritis Siswapada Materi Larutan Penyangga. *JCAE (Journal of Chemistry And Education)*, *1*(1): 143-150.

[27] Tanzila, R., & Mahardika, I. K. (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.

[28] Muna, I. A. (2017). Model pembelajaran POE (predict-observe-explain) dalam meningkatkan pemahaman konsep dan keterampilan proses IPA. *El-Wasathiya: Jurnal Studi Agama*, *5*(1): 73-92.

[29] Suranti, M., Yusuf, M., & Payu, C. S. (2018). Pengaruh Penerapan Model Pembelajaran POE (Predict Observe Explain) terhadap Hasil Belajar Siswa Materi Getaran dan Gelombang. *Jambura Journal of Educational Chemistry*, *13*(2): 227-231.

[30] Supriyati, S. (2015). Pengembangan Model Pembelajaran Predict-observe-explain-write Untuk Mendapatkan Gambaran Kuantitas Miskonsepsi Siswa SMA Materi Suhu Dan Kalor. *Jurnal Pendidikan Fisika*, *3*(2): 1-13.