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# Improving Science Conceptual Understanding and Science Process Skills in Elementary School using Predict-Observe-Explain Learning Model

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**Abstract:** This study aims to determine the effect of the Predict-Observe-Explain (POE) model as an alternative learning to improve students' understanding of science concepts and process skills. All experimental designs with the Non-Equivalent Control Group Design were applied to this study. Population were all fourth-grade students at MI Nurul Islam, South Lampung. The sampling technique used non-probability sampling, with class IV A as the experimental class and class IV B as the control class. The instrument for understanding the science concept was description test and SPS assessment with a practicum observation sheet. Statistical data processing techniques were carried out descriptively and inferentially with hypothesis testing using multivariate of variance (MANOVA) with a significance level of 5%. The results showed that the average value of the experimental class was higher than that of the control class. Likewise, the results of hypothesis testing show that there is an increase in conceptual understanding and science process skills in the experimental class compared to the control class. It can be concluded that the POE learning model can be used as an alternative to improve students' understanding of science science concepts and process skills in elementary schools.

**Keywords:** POE learning model, conceptual understanding, and science process skills.

***Abstrak:*** *Penelitian ini bertujuan untuk mengetahui pengaruh model Predict-Observe-Explain (POE) sebagai alternatif pembelajaran untuk meningkatkan pemahaman konsep dan keterampilan proses sains siswa. Desain eksperimen semua dengan tipe Nonequivalent Control Group Desain diterapkan pada penelitian ini. Populasi penelitian adalah seluruh siswa kelas IV di MI Nurul Islam Lampung Selatan. Teknik pengambilan sampel menggunakan Non Probability Sampling, dengan kelas IV A sebagai kelas eksperimen dan kelas IV B sebagai kelas kontrol. Instrument pemahaman konsep IPA berbentuk tes uraian dan penilaian SPS dengan lembar observasi praktikum. Teknik pengolahan data statistik dilakukan secara deskriptif dan inferensial dengan uji hipotesis menggunakan multivariate of variance (MANOVA) dengan taraf signifikansi 5 %. Hasil penelitian menunjukkan bahwa nilai rata-rata kelas eksperimen lebih tinggi dibanding kelas kontrol. Begitu juga hasil pengujian hipotesis diketahui bahwa terdapat peningkatan pemahaman konsep dan keterampilan proses sains pada kelas eksperimen dibanding kelas kontrol. Dapat disimpulkan bahwa model pembelajaran POE dapat diajadikan alternatif untuk meningkatkan pemahaman konsep dan keterampilan proses sains IPA siswa di SD.*

***Kata kunci:*** *model POE, pemahaman konsep, dan keterampilan proses sains.*

## ▪ INTRODUCTION

Learning includes interaction between teachers and students with learning resources in an environment that exchanges knowledge and information. Learning is the assistance provided by the teacher so that the process of acquiring knowledge occurs, mastering skills and character, as well as forming attitudes and beliefs in students. In

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other words, learning is a process to help students get better learning outcomes (Haryanto, 2020). In its application, learning involves various elements, such as methods (various learning models), media (print, visuals/images, audio and multimedia) and also learning designs ranging from the simplest (listening) to the most complex (practice trials). (Ananda & Afdillah, 2018).

Likewise, science learning is a combination of two main elements, namely process and product. Science as a process includes process skills and scientific attitudes that need to be developed to acquire and strengthen knowledge. While science as a product is a collection of facts, concepts, generalizations, principles, theories and laws. Understanding the concept is defined as an ability to be able to express a meaning. Understanding of concepts refers to the ability of students to be able to connect concepts they have with concepts that are newly known to describe situations in different ways. Students' understanding of concepts will increase if their reasoning abilities develop.

Science Process Skills (SPS) is a student's ability to apply the scientific method to understand, develop and discover scientific knowledge. SPS aims for students to be more active in understanding and mastering the sequences that are carried out such as observing, grouping, interpreting, predicting, hypothesizing, planning experiments and communicating. Science process skills are physical (hand-on) and mental (mind-on) skills that is important to have, master and apply in a scientific activity so that scientists can find something new. In this regard, teachers are required to create innovative and adaptive learning conditions in line with the progress of science and the complexity of the demands of the current level of thinking. This aims to make learning more interesting and increase student motivation. The teacher no longer naturally has a more dominant role in the class, but must place students as active subjects of learning (Suyono, 2018). Therefore, studying and critically examining various learning models from various references is an endeavor so that the goal of teaching students can be achieved completely (Al-Tabany, 2014).

The facts that occur in the field, the science learning process is mostly carried out by direct instruction, with more learning activities by lecturing, question and answer, discussions, and assignments (answering practice questions). As a result, many students only understand the concept of science material in the abstract and this condition greatly impacts their mastery of practice, where the skills needed when conducting science experiments are not optimized. Based on the initial data review, there were problems related to understanding the concept, in the aspect of interpreting the percentage of 59.1%, exemplifying the percentage of 37.8%, classifying 34.8%, summarizing 43.9%, concluding 42.4%, comparing 37, 8%, and explains 43.1%. Overall, it means that it is in the sufficient criteria, so that in conclusion students' understanding of the concept is still low. Likewise in the SPS assessment, several indicators have not developed optimally, such as predicting, conducting simple experiments, and communicating.

The application of the POE (Predict, Observe, Explaining) learning model can be an alternative because it can help students make assumptions about a problem. Then students will observe whether the conjecture that was put forward at the beginning was true or not, which then encourages them to do proof by conducting experiments. After students obtain observational and experimental data, students will receive an explanation of these results, so that by using the POE model of natural science as a process and product, students will be obtained as a whole (Safitri and Hariono). Thus,

this POE model is very student-centered, so it is intended to improve students' understanding of SPS concepts and concepts. At the prediction stage, students are given the opportunity to convey ideas, argue, and provide reviews. In this process students' initial understanding begins to be stimulated, explored, and explored to make logical, observable, and critical conjectures. Therefore, this process directly helps students in generating their conceptual understanding of the material being studied. Then, the second stage, observation. students' conceptual understanding is encouraged to be improved by exploring concepts, arousing the desire to investigate. prove their predictions by optimizing their senses, associating facts, and being skilled at using observation tools ranging from conventional to sophisticated technology. Finally, after the observation data has been collected, students' conceptual understanding is honed again to be able to explain their findings when making observations by means of creative, critical and analytical thinking. Here students' thinking skills in understanding science material concepts are demanded fully as a whole. If examined carefully, in each stage of the POE model, the ability of students' science science skills skills simultaneously and continuously is always trained, such as observing, classifying, measuring, predicting, analyzing, communicating. and concluding. That way, it is hoped that the knowledge and skills that have been built can be firmly attached and last for a long time

## ▪ METHOD

This research approach is quantitative with experimental methods. This type of experiment uses Quasi experiment. The experimental design was the Nonequivalent Control Group Design, this study was almost the same as the Pretest-Posttest Control Group Design, only in this design the experimental and control groups were not randomly selected. The research population was all fourth grade students at MI Nurul Islam, South Lampung. The sampling technique uses Non Probability Sampling. In the first class is the experimental group that gets treatment with the POE (Predict-Observe-Explain) learning model, while in the second class is the control group that gets treatment using the Direct Instruction learning model. The instrument used is in the form of test questions in the form of descriptions for understanding concepts, while science process skills use practicum observation sheets.

In this study, research questions were analyzed by processing descriptive statistical data and by testing the MANOVA (Multivariative Analysis of Variance) hypothesis, which is a technique in statistics to calculate the significance of the difference from the average in research conducted simultaneously with two or more groups. The advantage of the MANOVA test is that it can examine the dependent variable simultaneously, which can minimize type I errors (α) when making statistical test decisions. The significance level uses 5% (0.05).

## ▪ RESULT AND DISSCUSSION

Based on the results of statistical data processing, the following description is obtained:

**Description of the POE Model on Increasing students' conceptual understanding**

Table 1 shows that the results of the pretest and posttest data on students' understanding of the concept of the experimental class with an average score of 45.1 and 79.3. Before receiving treatment, the comparison indicator became the indicator with the highest pretest average value, namely 61, while the lowest pretest average value, namely the classifying indicator, was 32.5. After receiving the exemplary treatment, it becomes an indicator with the highest posttest average score, namely 90, while the indicator with the lowest posttest average score, the indicator concludes, namely 69.3.

**Table 1.** Data Pretest and Posttest of Concept Understanding in Experiment Class

| | **Experimental Class** | | | | | |
|---|---|---|---|---|---|---|
| **Indicators** | **No Question** | **Pretest** | **Mean** | **No Question** | **Posttest** | **Mean** |
| Interpret | 2 | 48 | 34 | 11 | 98 | 89 |
| | 11 | 20 | | 7 | 80 | |
| Give an Example | 5 | 49 | 56.5 | 3 | 90 | 90 |
| | 10 | 64 | | 6 | 90 | |
| Classify | 3 | 29 | 32.5 | 8 | 52 | 72 |
| | 8 | 36 | | 15 | 92 | |
| Summarize | 13 | 22 | 48 | 4 | 68 | 70 |
| | 14 | 74 | | 13 | 72 | |
| Conclude | 7 | 24 | 34.7 | 12 | 52 | 69.3 |
| | 9 | 36 | | 10 | 68 | |
| | 15 | 76 | | 9 | 88 | |
| Compare | 6 | 46 | 61 | 14 | 86 | 88 |
| | 12 | 66 | | 5 | 90 | |
| Explain | 1 | 32 | 49 | 1 | 78 | 73 |
| | 4 | | | 2 | 76 | |
| **Mean of students' conceptual understanding** | | | **45.1** | | | **79.3** |

**Table 2.** Data Pretest and Posttest of Concept Understanding in Control Class

| | **Control Class** | | | | | |
|---|---|---|---|---|---|---|
| **Indicators** | **No Question** | **Pretest** | **Mean** | **No Question** | **Posttest** | **Mean** |
| Interpret | 2 | 43 | 39 | 11 | 82 | 72 |
| | 11 | 35 | | 7 | 62 | |
| Give an Example | 5 | 43 | 46 | 3 | 86 | 75 |
| | 10 | 49 | | 6 | 64 | |
| Classify | 3 | 26 | 28 | 8 | 46 | 68 |
| | 8 | 30 | | 15 | 90 | |
| Summarize | 13 | 28 | 40 | 4 | 76 | 68 |
| | 14 | 53 | | 13 | 60 | |
| Conclude | 7 | 33 | 38 | 12 | 40 | 60 |
| | 9 | 35 | | 10 | 62 | |
| | 15 | 46 | | 9 | 78 | |
| Compare | 6 | 50 | 49 | 14 | 76 | 87 |

| Indicators | Control Class | | | | | |
|---|---|---|---|---|---|---|
| | No Question | Pretest | Mean | No Question | Posttest | Mean |
| | 12 | 49 | | 5 | 98 | |
| Explain | 1 | 38 | 30 | 1 | 66 | 68 |
| | 4 | 22 | | 2 | 70 | |
| **Mean of students' conceptual understanding** | | | **38.7** | | | **71.1** |

Table 2 shows that the results of the pretest and posttest data for understanding the concepts of control class students with an average score of 38.7 and 71.1. Before receiving treatment, the comparison indicator became the indicator with the highest pretest average value, namely 49, while the lowest pretest average value, namely the classifying indicator, namely 28. After receiving treatment, comparing was still an indicator with the highest posttest average value, namely 87, while the indicator with the lowest posttest average score the indicator concludes is 60.

**Description of the POE Model on Increasing Students' Science Process Skills**

**Table 3.** Data Percentage of SPS

| No | Group | Meeting | | | | Mean | Category |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | | |
| | | (%) | | | | | |
| 1 | Experiment | 81 | 85 | 87 | 91 | 86 | Excellent |
| 2 | Control | 72 | 80 | 81 | 81 | 79 | Good |

Based on the table above, it shows the distribution of SPS percentage values at four meetings in the experimental class showing high values with a total average of 86%. While the distribution of SPS percentage values at four meetings in the control class also shows values that move from medium to high values with a total average of 79%. In conclusion, because the average value of the experimental class is greater than the average value of the control class, it means that the application of the POE model is better than the DI model in improving students' science process skills.

**Effect of the POE Model on Increasing Students' Understanding of Science Concepts and Process Skills**

The results of the MANOVA test with SPSS 26.00 software for windows are known;

**Table 4.** Multivariate tests[a]

| Effect | | Value | F | Hypothesis df | Error df | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|---|
| CLASS | Pillai's Trace | .319 | 8.681[b] | 2.000 | 37.000 | .001 | .319 |
| | Wilks' Lambda | .681 | 8.681[b] | 2.000 | 37.000 | .001 | .319 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Hotelling's Trace | .469 | 8.681[b] | 2.000 | 37.000 | .001 | .319 |
| | Roy's Largest Root | .469 | 8.681[b] | 2.000 | 37.000 | .001 | .319 |

a. Design: Intercept + CLASS

b. Exact statistic

The results of the analysis show that the F value for Pilae Trace, Wilk Lambda, Hotelling Trace, Roy's Largest Root is 8.681 with a significance level of 0.001. This means that the level of implementation of the POE (Predict-Observe-Explain) learning model has a significant effect on increasing students' understanding of science concepts and process skills in a multivariate manner. Furthermore, based on the results of the Test of Between-Subjects Effects table, it shows a significance value for the concept understanding variable, namely 0.009 and science process skills, namely 0.000, the two variables have a significance value that is smaller than the 0.05 significance level. This means that H0 is rejected and Ha is accepted

In Table 1, even though there was a change in the increase in the indicators of understanding of the concept (between pretest to posttest) but after being given treatment it can be seen significantly with the POE model that there was an increase in all indicators of understanding the concept. While seen in table 2 with the DI (Direct Instruction) model the increase in the average value (mean) in the control group is not as big as in the experimental group. With indicators of conceptual understanding exemplifying higher in the experimental class and indicators of understanding of concepts comparing higher in the control class. When analyzed further, these two characteristics of ways of thinking have different learning approaches and need further analysis.

Overall, the analysis of the descriptive statistical data above can provide information that the application of the POE (Predict-Observe-Explain) learning model can be an alternative to overcome students' difficulties in understanding science concepts. Because in each indicator, namely interpreting, exemplifying, classifying, summarizing, concluding, comparing, and explaining, students are conditioned, trained, and stimulated to be able to have all of these indicators in achieving students' cognitive learning outcomes. Although admittedly not all indicators of students' ability to understand concepts can be achieved, this can be material for reflection on how learning in the future can be achieved as a whole. With the POE model, at least in the learning process students have begun to be directed not only to memorize the concepts of the material being taught, but students are guided and guided to be able to better understand the concepts of the material in depth. It is known that understanding is a higher level of thinking ability than memory or memorization. This is in accordance with what Sanaya wrote that understanding is at a higher level than knowledge. Understanding or comprehension can be interpreted as mastering something with the mind. In other words, understanding is knowing about something and being able to see it from various angles. A learner is said to understand something if he can provide an explanation or provide a more detailed description of something using his own words. Thus, understanding is not just remembering facts, but with regard to the ability to explain,

explain, interpret or the ability to grasp the meaning or meaning of a concept (Yolanda, 2020).

Likewise, if it is observed in Table 3, it shows that the percentage of students' SPS in the experimental class shows a higher value than in the control class. Guidance to be able to practice SPS in science practicum activities means guiding students to have the ability to observe, classify, measure, predict, analyze, communicate, and conclude. . That way hand-on and mind-on stimulated activities run in balance. In conclusion, the application of the POE model is better at increasing students' understanding of science concepts and process skills. This is also evidenced in Table 4 where all F values for Pilae Trace, Wilk Lambda, Hotelling Trace, Roy's Largest Root produce a value of 8.681 with a significance level of 0.001. This means that the level of implementation of the POE (Predict-Observe-Explain) learning model has a significant effect on increasing students' understanding of science concepts and process skills in a multivariate manner

In its application, the application of the POE model really helps students understand concepts through problem-solving thinking skills. It begins by confronting students with a problem. Then, students are invited to make predictions at the beginning of learning in order to find out the initial concepts that students have. Furthermore, to prove their predictions, students are required to observe by conducting experiments and making explanations. Thus, the three stages of the POE model greatly influence students' understanding of concepts because from here students can easily understand material concepts because students play a direct role in the explanation so that it will encourage students to remember the material they have learned at that time.

In addition, the POE model also helps improve students' science process skills, especially by conducting simple experiments at the observation stage. The prediction stage, students are expected to be able to make an assumption to find out the students' initial knowledge, so that the observed science process skills are predictive skills. Students have to prove whether their predictions are right or wrong at the observation stage, at this stage students have to do simple experiments involving observation, classification and measuring process skills. The third stage of the POE learning model is to explain or explain, after getting the results of the simple experiments that have been carried out in the observe stage, students are required to explain the results of the simple experiments and explain whether the initial predictions they made with the results of simple experiments that have been carried out are correct, skills The trained science processes are communication and explaining.

Based on the description of the stages in the POE learning model, the three stages, namely predict, observe and explain, greatly influence students' science process skills. Because at this stage of the learning model there are 6 indicators of basic science process skills. The indicators for predicting are in the predict stage. Observation, classification and measuring indicators are in the observe stage. Communication indicators and conclusions are in the explain stage. With this learning pattern, the POE model is very much focused on constructivism learning theory where every student is considered to have great potential to be able to develop their thinking skills and independent learning. Therefore, it is appropriate for the teacher's task to facilitate the development of student learning so that they play an active role in seeking and finding knowledge by discussing and conducting experimentation (Septatiningtyas, 2021).

This learning activity becomes something important in order to provide assistance to students who really need guidance and assistance in the learning process, so that in the end each student gains mastery of the same knowledge. In other words, learning is successful in helping students' difficulties in understanding the lesson. These results are in accordance with the opinion expressed by Sudjana that learning is any effort made intentionally by educators that can cause students to carry out learning activities. Nasution defines learning as an organized activity or manages the environment as well as possible and connects with students so that the learning process occurs.

The above argument further strengthens the results of Sumirat (2017) research, state that the POE Model is effective in facilitating conceptual changes in elementary students in learning science. Safitri et al (2019) confirm that the influence of the Predict, Observe, Explain (POE) learning model on student physics learning outcomes. Hidayah & Yuberti (2018) test the truth of the hypothesis, namely that there was a significant effect of using the Predict-Observe-Explain (POE) learning model on students' learning process skills in the experimental class. This research study strengthens the findings of this study that the POE model is effective in facilitating students' conceptual changes, students' Physics learning outcomes, and students' Science Process Skills. In this study, researchers have also proven the truth that concurrently understanding concepts and process skills can be improved by the POE model. Of course, for the development of science, the results of this research can be a reference for teaching science in a balanced cognitive and psychomotor manner.

## ▪ CONCLUSION

Based on the results of the POE (Predict-Observe-Explain) model research, it can be used as an alternative to improve conceptual understanding and science process skills for class IV MI Nurul Islam students. This can be seen from the results of testing the data with descriptive statistics showing that the average achievement of students' understanding of concepts and SPS is higher in the experimental group than the control group. Then it was also proven from the results of the MANOVA hypothesis test which showed that students' understanding of concepts and science process skills got an F value for Pilae Trace, Wilk Lambda, Hotelling Trace, Roy's Largest Root having a significance smaller than 0.05. That is, the values of F are all significant. Furthermore, based on the results of the Test of Between-Subjects Effects table, it shows a significance value for the concept understanding variable, namely 0.009 and science process skills, namely 0.000, the two variables have a significance value that is smaller than the 0.05 significance level. This means that Ho is rejected and Ha is accepted

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