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# Predict Observe Explain (POE) strategy toward mental model of primary students

L Jasdilla<sup>1\*</sup>, Y Fitria<sup>2</sup> and W Sopandi<sup>3</sup>

<sup>1</sup> Pendidikan Dasar, Universitas Pendidikan Indonesia, Jl. Dr.Setiabudi No. 229, Bandung 40154, Indonesia

<sup>2</sup> Departemen Pendidikan Guru Sekolah Dasar, Universitas Negeri Padang, Jl. Prof.Dr.Hamka Air Tawar, Padang 25171, Indonesia

<sup>3</sup> Departemen Kimia, Universitas Pendidikan Indonesia, Jl. Dr.Setiabudi No. 229, Bandung 40154, Indonesia

\*lolijasdilla@student.upi.edu

**Abstract.** A mental model is an inaccurate and complete storage of basic or incomplete knowledge that arises from previous experience and can then develop if one can increase knowledge through the process of cognition. A person's mental model can be changed or modified through the learning process. Therefore, the purpose of this research is to test Predict Observe Explain (POE) strategy to change the mental model of fifth grade in material of light. This research used quantitative research method with quasi experimental design. Population in this research were fifth grade of Jayagiri village, LembangSubdistrict. The sample of this research was class V students in one of the elementary schools of Lembang sub-district. The sampling technique was done purposively. Data collection techniques in this study were objective tests. Meanwhile, the instrument used was a two tier test that has been empirically validated. The data in the study was analyzed with descriptive and inference statistic. Result in this research shows that Predict Observe Explain (POE) strategy has effect on the change of mental model of primary students.

## 1. Introduction

Science literacy is an individual's skill to use science concepts and skills so as to judge everyday decisions when it comes to connecting with others, the environment, and understanding the interactions between science, technology and society [1]. Referring to the definition of science literacy, the researchers conclude that to achieve science literacy, students should understand the various concepts in learning.

Student's understanding of a concept can be identified through the analysis of the mental model that the students have. A mental model is an idea that represents one's thinking to understand and explain an occasionally inaccurate or incomplete phenomenon that arises from experience, and can develop when a person improves his knowledge through the process of cognition and the mental model is used to formulate predictions based on explanations [2,3,4]. Each individual has a different mental model, this depends on the student's representation in solving the problem, because problem solving will rely on the construction and manipulation of the student's mental model [5,6]. When students have a complete mental model, then students will be able to make a good explanation of the problems in the IPA. Conversely, if students have a mental model that is wrong or not intact, then students will find it difficult to solve the problem of IPA and cause misconception [7].



In learning for a teacher, the mental model can be the starting point to facilitate the student's early knowledge to build up the next new knowledge and achieve a complete and more scientific understanding [8]. Mental models are an important component of learning. The importance of mental models of students can be seen from several research results. A student's experience determines the initial way of thinking as a mental model of what he observes, and the mental model relates to the cognitive changes experienced by later students [9]. Further research to analyze the mental model of students in physics learning. The result of mental model analysis showed that students have low mental model in physics learning. The mental model of students still exists in the initial category. Students are still in macroscopic stages and have difficulties to master the material in the microscopic stage [10]. Most individuals have a mental model that is in the category of initials and synthesis [11].

In Indonesia, there is still not much research on mental models of students in science learning. Based on the results of interviews with one of the science teachers at the school, stated that indeed if the teach a concept has never used a mental model. Teachers simply provide theory while students tend to memorize theories so that the students' mental models are not well formed [12]. In addition, the mental model test results in elementary school indicate that there are still many mental models of students who have not yet formed intact [13]. If students are left to advance with improper concepts or incomplete mental models, it will lead to future learning problems [14].

Based on the results of previous research, there should be an effort to solve the problem to build a mental model of students. As an effort to solve the problem of the mental model of the students that teachers implement the learning that supports the development of mental models of students.

The Predict Observe Explain (POE) learning strategy can be a teacher's solution to support the development of a student's mental model. Predict Observe Explain Strategy (POE) is a learning strategy that enables students to be active in the learning process. Through the Predict Observe Explain (POE) strategy students have the opportunity to construct their knowledge, observe the phenomenon, and communicate thoughts and write down the results of the discussion [15]. Predict Observe Explain Strategy (POE) will cause student participation in learning to be great. Students have the opportunity to release information they know. Students eventually construct and combine their initial knowledge with the knowledge they just got [16]. The Predict Observe Explain (POE) strategy helps students to reveal their initial knowledge and offers more opportunities to share and discuss their own interpretations [17]. Therefore, the Predict Observe Explain (POE) strategy has an impact on the development of mental models of students.

Based on the above description, the mental model of students in science learning in Indonesia has not been fully formed intact to become a scientific model of psychic, besides the researcher revealed that research related to mental model many use qualitative approach to analyze student mental model. However, research on testing a strategy against a student's mental model is still rare. Meanwhile, research on the application of Predict Observe Explain (POE) strategy has been done by many researchers before but research on the change of mental model through Predict Observe Explain (POE) strategy has not been found. Therefore, based on the limitations and recommendations of some of the studies described above, the authors are interested in researching this study with the title Predict Observe Explain (POE) strategy toward the mental model of primary students.

## 2. Method

This research used quantitative approach with quasi method of experiment. Quasi experimental research is a study that aims to examine the impact or influence of research variables. The population of this research was the students of grade V of elementary school in cluster Jayagiri Kecamatan Lembang. Jayagiri cluster consists of 6 schools with the number of students of class V that is 329. The sample of the research was the grade V students in one of the primary schools in Jayagiri cluster, Lembangyang sub-district totaling 58 students. The researchers classified the study sample into two groups, namely the experimental and control group. In this design, both groups were not randomly selected or involved placement (but not random placement) of participants to the group because the experimenter could not create the group artificially for his experiment [18]. This study was conducted in the even semester of the academic year 2016/2017.

In this study, mental model changes were measured using a diagnostic test consisting of questions in the form of two tier tests in the form of choice of answers and choice of reasons to answer or solve the concept of light to be categorized into initials, synthetics, and scientific. Initial category is used to correct answer and correct reason. Scientific category is used to correct answer and wrong reason. Initial category is used to wrong answer and wrong reason or wrong answer and correct reason. Meanwhile, the scoring used in the study refers to the adaptation guidelines [19]. Table 1 shows the scoring technique in this study. Furthermore, the researcher sums up the whole score and divides it by a total score.

**Table1.** Two tier test score

Criteria	Score
Correct answer + Correct reason	2
Correct answer + Wrong reason	1
Wrong answer + Wrong reason	0
Wrong answer + Correct reason	0

### 3. Result and Discussion

Distribution of mental model changes for experimental and control classes. Table 2 shows the mean percentage of mental models of experimental class and control class students. Based on the percentage outcomes that have been described, the researcher concludes that the students' mental models of experimental classes on pretest are lower than the students' mental models on posttest. This is proven by percentage of mental model of pretest and posttest experiment class, ie 34% and 68,1%. Then, table 3 shows the students' mental model of control class on posttest which is in the lower initial category of pretest. Furthermore, the control class on pretest obtained a mean percentage of 26.4% in the synthesis category whereas posttest obtained 15%. This shows the posttest result in the lower synthesis category than the pretest result. Meanwhile, in the scientific category the pretest obtained 24.6% while the posttest obtained 48.6%. This shows the student on the posttest of the scientific category is higher than the pretest result.

**Table 2.** Results of mental models of students

The mental model for the experimental class			The mental model for the control class		
Category	pretest	Posttest	Category	Pretest	posttest
Initial	43,8%	20,4%	Initial	49%	36,4%
Synthetic	22,2%	11,5%	Synthetic	26,4%	15%
Scientific	34%	68,1%	Scientific	24,6%	48,6%

Based on the description above, the experimental class students experience better mental model changes than the control class students. This is evident from the acquisition of percentage of scientific model of experimental students in higher experimental class than control class students. The acquisition of a scientific model is the impact of the Predict Observe Explain (POE) strategy that the experimental class students receive so that the mental models of students in the scientific category undergo a good change. Based on these results the use of the Predict Observe Explain (POE) strategy is useful for generating and supporting the discovery of concepts in student science discussions and can also help students to explore and improve the conclusions they get [20].

However, that needs to be considered in the mental model changes of students that there are students who are still in the category of initials and synthetics. This happens because each student has different abilities and understanding. There are students who can follow the learning but they do not understand the meaning of learning. There are students who have low concentration power so less able to follow the learning in a long time. Nevertheless, the results of this study prove that Predict Observe Explain (POE) strategy can change the student's mental model. The spreading of the students' mental model changes on the concept of light is shown through table 3.

**Table 3.** The spread of changes in students' mental models on the concept of light

Pretest	Category	Average Percentage	
	Posttest	Experiment	Control
Initial	Initial	15,6%	27,4%
	Synthetic	4,7%	3,5%
	Scientific	23,5%	18,1%
Synthetic	Initial	2,9%	5,2%
	Synthetic	5,2%	9,3%
	Scientific	14,1%	11,9%
Scientific	Initial	1,9%	3,8%
	Synthetic	1,6%	2,2%
	Scientific	30,5%	18,6%

Table 3 shows the changes in mental models of experimental class and control class students. In the experimental class, students who had a mental model with the initial category after treatment, 15.6% experienced a fixed mental model, while the mental model changes students from the initial category to the synthesis category of 4.7%. Changes in the mental model of students from the category of initials to the scientific as much as 23.5%. Based on the acquisition percentage, the researcher concludes that the mental model of students undergoing a change. This is indicated from the acquisition of the percentage of initial categories to the scientific is quite a lot. However, not all students experience a mental model change because there are still students who are in the initial category. It causes students to still have a fixed and synthetic mental model because students have different levels of understanding and students also have not mastered the concept. Students have a synthetic mental model because they have not been able to associate a concept with relevant examples in everyday life [21].

Meanwhile, in the synthetic category, the change to the initial category is only 2.9%, while the fixed is 5.2% and towards the mental model category is intact or scientifically that is equal to 14.1%. Based on the acquisition of the synthetic percentage, the change of mental model of the students towards the better, although there are still in the synthetic category even changed to the initial category. Furthermore, in the scientific category, only slightly changes in the initial and synthetic categories. Based on the percentage gain, the mental models of experimental class students in the categories of initials and synthetic categories can be minimized and the scientific category improves. Therefore, the researcher concludes that the student's mental model is changing while the change in the control class model is not as good as the experimental class. It is evident that there are still many students who keep answering in the initial and synthetic categories and changes to the scientific category are not as good as the experimental class.

To see the effect of Predict Observe Explain strategy (POE) then the researchers calculate N-gain. N-gain is the difference between the posttest value with the pretest value then divided by the result of the reduction between the maximum value and the posttest value. Decision-making criteria is determined if the significance value of P-value  $< \alpha$  (significance level 0.05), then  $H_0$  is rejected. If the value of significance P-value  $\geq \alpha$ , then  $H_0$  accepted. Based on the calculation results using SPSS 20 for windows software obtained the test results difference in average score N-gain for the experimental class of 0.53. While the average N-gain for the control class is 0.29. N-gain of the experimental class is included in the moderate category and the control class is included in the low category. Meanwhile, according to the result, the average difference test or t-test of student's N-gain value is 0,00. The result is smaller than the 0.05 significance value so the null hypothesis is rejected. Based on the result of t-test, the researcher concludes that there is influence of Predict Observe Explain (POE) strategy to student's mental model on class V light material.

Changes in mental models can occur well if students are directly involved in the process of acquiring new knowledge. In addition, students' mental models develop and are well-formed because the experiences they gain in learning are not based on the memorized theory [22]. Through the Predict Observe Explain (POE) strategy, students are trained to create hypotheses (conjectures) on a phenomenon. The activity of proposing the hypothesis becomes an arena to express the various opinions

held by the students. Students who previously lacked the courage to express opinions became more daring because in proposing the hypothesis is not determined which one is right and what is wrong. The students themselves can know the accuracy or error of the hypothesis after they have observed [23]. Implementation of Predict Observe Explain (POE) strategy, affect the change of mental model of students. This is because the Predict Observe Explain (POE) strategy has many learning steps involving students. Student involvement in learning will have an impact on meaningful learning because learning is said to be meaningful if the information learned by the students is structured according to the cognitive structure it possesses [24].

#### 4. Conclusion

A mental model is an idea that represents one's thinking to understand and explain a phenomenon or storage of prior or incomplete and incomplete basic knowledge that arises from previous experience and then develops when one can increase his knowledge through the process of cognition. The results showed that the mental model of grade V students experienced a better change after getting treatment with Predict Observe Explain strategy. It indicates that Predict Observe Explain strategy has an effect on the change of mental model of class V students.

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