

Reducing Light Misconceptions by Using Predict-Observe-Explain Strategies

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Abstract—The reason for the low quality of science education in general is the existence of misconception and learning conditions that are less attention to the preconceptions of learners. Misconceptions of light can occur at any age level. The purpose of this study is to demonstrate that Predict-Observe-Explain strategies can reduce misconceptions of learners. This research method using True Experiment Design. In the experimental ofgroup learning used the strategy of POE while in the control group used conventional learning. The results showed that the mean misconception in the experimental group was smaller than the mean misconception in the control group. These results indicate that the POE strategy is appropriate to reduce the misconception of elementary school students on the subject of Light

Keywords— *misconception; POE; Strategy*

I. INTRODUCTION

The misconceptions of light matter can occur at any age level. Several studies have shown that misconceptions occur at the level of teachers, students, through primary school students. Sundaru & Euwe (ED) Van den [1] found a misconception of light material that occurs in elementary school teachers and students of D3 Biology, that the speed of light from sources with higher intensity runs faster than light depending on the source and some other variables. Abeljalil Metioui & Louis Trudelound a misconception on the teacher of light matter, namely light does not always traveling in a straight line, the spreading of light in a straight line, but only in a horizontal direction, light reflected when encountering object in the path, light change its direction the same area.

The researchers of misconceptions found various things that cause misconceptions in students. Suparno revealed several causes of misconception namely the condition of students, teachers, learning methods, books and context.

The most common misconceptions in elementary school on the subject of Light according to [2] brighter light moves faster; 2) in the process of seeing, eyes emit light; 3) the closer distance of the object to the eye, the bigger object look alike; 4) many

students make a mistake in drawing normal lines, incoming rays, and reflected ray; 5) the direction of the light coming in opposite to the direction of the reflected ray; 6) when light travels from air to water, light turns in water; 7) when the pencil inserted into water, the pencil appears to be bent because it is biased; 8) the lens always made from a glass with a symmetrical curved shape; 9) is it true that the shadow formed by a half closed lens or closed in the center or closed in the edges is half as well?; 10) mixing various colors (red, orange, green, indigo, purple) will produce white color.

Based on the results of previous misconceptions research, researcher want to conduct a research to identify misconceptions that experienced by sixth grade students of SDN 3 Petiken on science subjects with light matter. Based on the above background, appeared other problem as well namely "how to reduce student misconception with POE strategy (Predict-Observe-Explain) on the subject of light?"

Based on the problems formulation and research questions above, the main objective to be achieved in this research was to show the effect of the eligible POE strategy to reduce the misconception of elementary students about the subject of Light.

The concept is a small piece of information. Concept is an abstraction of the features of something that facilitates communication between people and allows human to think. In simple language, concept is a unique identity number. A concept becomes meaningful if it has a relationship with another ones, in other words, concept can contain information if it has a relation with another concept [1].

Preconception is a conception of one particular phenomenon that has existed in students from a previous life or learning experience that is not necessarily the same of scientist's concept [1]. Student's preconceptions generally will change as students learn the correct concepts. A condition if a preconception is difficult to change and always returns to its original preconception then this condition is called misconception.

Student's misconceptions can be interpreted as student's conceptions of a particular concept that is inconsistent with concepts that understood by scientists [1]. Ibrahim [2] defines misconception as a false idea or an incorrect view of a concept that belongs to a person which different from a concept that deemed correct by the expert, usually this false view has a nature of resistance and persistence. Suparno [3] views misconceptions as an inaccurate misunderstanding of concepts, the use of misconceptions of misleading examples, the confusion of different concepts and the hierarchical relationships of incorrect concepts. Tayubi [6] defines misconception as "strongly held cognitive structures that mean misconceptions can be viewed as strongly embedded conceptions or cognitive structures and that are different from the accepted understanding in a field and that the presume to interfere with the acquisition of new knowledge" which mean that misconception can be viewed a strong conception or cognitive structure and stable in the minds of students who actually deviate from the conception put forward by scientists.

The aims of teaching concept according to [1] include: (1) defining the concept in question; (2) explain the difference between the concepts concerned with other concepts; (3) explaining the relationship with other concepts; (4) explain the meaning of concepts in everyday life and apply them in solving problems in everyday life.

Specifically [1] summarizes some of the dominant features of misconception as follows: (1) Misconceptions are difficult to repair; (2) Often the "remnants" of misconceptions continue to interfere; (3) Regression often occurs, that is, a situation in which the student once overcame misconception, but it was wrong again in a few months later; (4) with good lectures, misconceptions cannot be eliminated or avoided; (5) students, teachers, lecturers, and researchers can be the subject to misconception; (6) teachers and lecturers generally don't know the usual misconceptions in their students and do not adapt the learning process to misconception of their students; and (7) students of varying degrees may be exposed to misconceptions.

POE is an effective strategy for creating students' ideas or ideas and discussing their ideas [8]. The POE strategy involves students predicting the results of experiments and discussing the reasons for their predictions, conducting experiments and finally explaining the differences between their predictions and observations. To straighten out the misconceptions of light that occur in the fifth grade of SDN 3 Petiken by using POE strategies

II. METHOD

First, confirm that you have the correct template for your paper size. This template has been tailored for output on the A4 paper size. The method used is true experiment method with control group pretest posttest research design. The researcher experimental group to the sample, then the researcher wanted to know the effect of the treatment. The intended treatment was to

implement learning using POE strategy in teaching the concepts of light subject.

The subjects of this study was fifth grader B SDN 3 Petiken as the experimental group and fifth graders D as the control group with the number of samples taken as many 10 students for the limited test and 30 students for the extensive test. Judging from the general students' cognitive aspect abilities will showed the same, and these 2 classes have never done learning using the POE strategy. Initial study (observation) of this research has been carried out in November 2017, then continued on \pm 1 month in the even semester in the academic year 2017/2018.

Data collection techniques that used in this study were observasion and questionnaires. Observasion technique aims to obtain the data implementation of learning, obstacles encountered during the learning progress, and the attitude of students during learning by using the strategy POE. Observasions were made by two trained people who could operate the observasion sheets correctly. These observations were conducted on a face-to-face basis and consist of preliminary activities (apperception), main activities, closing, time management and classroom atmospher. The test in this study was a diagnostic test. Diagnostic tests were used to measure student's conceptual understanding or to identify misconceptions that occurred in students. Questionnaire filling aims to knowing student response to the implementation o learning activities. This questionnaire was used after the learning and filled out by students.

The operational definitions of the variables observed n this study were validity, practicality, and the effectiveness of instruction tools using POE strategy. Data analysis techniques that used in this study was the analysis of test results equipped with CRI Instruments. The data collected by the researchers will be arranged in the raw table, then processed on the finished data that has been prepared and analyzed and then can be drawn conclusions. Data analysis techniques used was descriptive statistical analysis. Descriptive statistical data analysis techniques were used to analyze data by describing data that has been collected without intending to make conclusions that apply to the general or generalization [4]. The data analyzed in this research were pretest and posttest samples. To test the pretest and posttest used t test analysis. The statistical test in this study was done with the help of computer software program SPSS 21 for windows. Equations.

III. RESULTS

The following graph presents the misconception score for the experimental group and the control group:

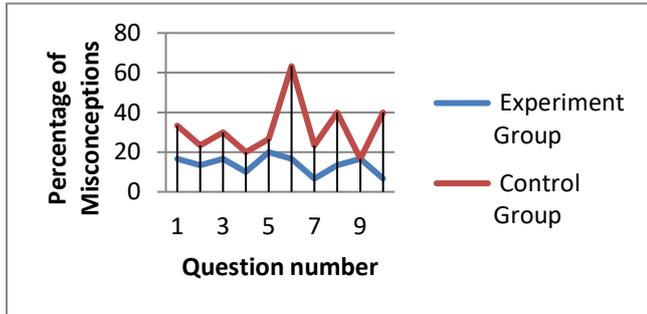


Fig. 1. Graph of Misconceptions Score of Experiment Group and Control Group

From Figure 1, it can be seen that the mean score of experimental group misconception is lower than control group. This misconception score was used to answer the research hypothesis, i.e. if the misconception on the subject of light can be reduce using the POE strategy, the misconception profile on the subject will decrease.

Based on the results t-test $t_{count} < t_{table}$, then H_0 research accepted and H_a rejected. The mean misconceptions of experimental groups that received by using POE strategy were smaller than the mean misconceptions of the control group treated with conventional learning. So it can be concluded that the POE strategy can be used to improve the science misconception on the subject of light for students of class V SDN 3 Petiken.

The analysis of per item test result data was done by analyzing each item of problem from the misconception diagnostic test that consisting of 10 questions. From each item the learner's answers were analyzed according to the degree of grouped understanding namely understanding concepts, misconceptions, guessing, and not understanding the concepts.

CRI analysis on Individual Pretest in Experiment Class and Control Class, can be seen in Table 1 below:

TABLE 1. RESULTS OF CRI ANALYSIS PRETEST EXPERIMENT CLASS AND CONTROL CLASS

Experiment class				Control class			
Percentage (%)				Percentage (%)			
MK	MKS	MBK	TMK	MK	MKS	MBK	TMK
22,73	36,36	22,73	18,18	40,91	50,00	9,09	0,00
40,91	54,55	4,55	0,00	31,82	54,55	4,55	9,09
18,18	31,82	22,73	27,27	45,45	45,45	4,55	4,55
36,36	40,91	9,09	13,64	36,36	45,45	9,09	9,09
22,73	27,27	40,91	9,09	36,36	22,73	4,55	36,36
22,73	31,82	18,18	27,27	45,45	18,18	9,09	27,27
9,09	40,91	13,64	36,36	22,73	31,82	9,09	36,36
9,09	45,45	4,55	40,91	18,18	59,09	13,64	9,09
63,64	22,73	4,55	9,09	81,82	13,64	4,55	0,00
27,27	50,00	4,55	18,18	9,09	68,18	9,09	13,64

Information :

- UC : Understanding Concepts
- MKS : Misconception
- MBK : Guessing

TMK : Not Understanding Concepts

Presented in graphical form analysis of CRI results on pretest experiment class will look like Figure 2:

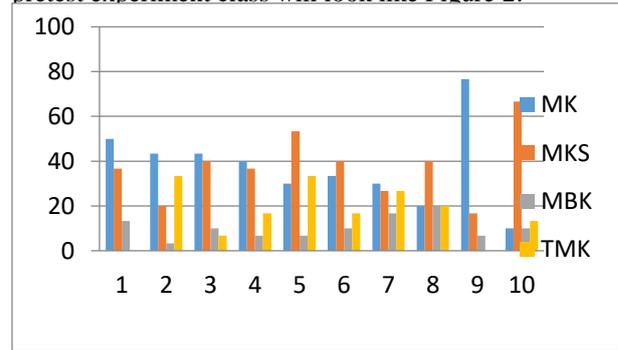


Fig. 2. Graph of Analysis of CRI Results on Pretest Class Experiments

In the control class the graphical form of CRI analysis on pretest will look like Graph 3

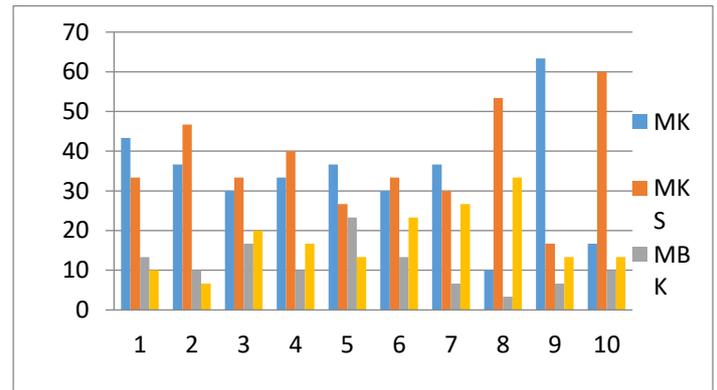


Fig. 3. Graph of Analysis of CRI Results on Pretest Class Experiments

Based on the data in Table 1 and Graph 3 it can be described that in the pretest results of the experimental class misconceptions occurred on the tested five concepts. Misconceptions with the largest percentage are in light only runs in dark place and the whole face shadow can be seen in a small mirror, as long as the mirror is near to the face. The amount of misconception percentage for both the respective number of questions was 53.33% and 50.00% respectively. The smallest percentage misconception was found in question. Test item about regular reflection that occurs in flat mirrors and the diffuse reflection occurs on plain white paper of 16.67%.

The description of the pretest misconception profile in the control class based on the data in Table 1 and Graph 2 also revealed misconceptions in the five concepts tested. Misconceptions with the largest percentage on item of number 8 namely in the process of seeing the eyes emit light and number item no.10 namely the shadow of the entire face can be seen in a small mirror, as long as the mirror near the face, the percentage of misconception for both problems respectively was 68.18% and 59.09%.

The smallest percentage misconception found in namely regular reflection occurs only in flat mirrors and the diffuse reflection occurs on plain white paper of 16.67%.

Detailed data on the results of individual posttest identification in the experimental class and control class will given in Table 2 as follows:

TABLE 2. RESULTS OF CRI ANALYSIS POSTTEST EXPERIMENT CLASS AND CONTROL CLASS

Experiment class				Control class			
Percentage (%)				Percentage (%)			
MK	MKS	MBK	TMK	MK	MKS	MBK	TMK
80,00	16,67	3,33	0,00	43,37	33,33	13,33	10,00
83,33	13,33	3,33	0,00	70,00	23,33	6,67	0,00
73,33	16,67	6,67	3,33	53,33	30,00	13,33	16,67
70,00	10,00	16,67	16,67	63,33	20,00	10,00	6,67
63,33	20,00	10,00	16,67	43,33	26,67	16,67	13,33
90,00	16,67	3,33	0,00	20,00	63,33	10,00	6,67
76,67	6,67	6,67	10,00	50,00	23,33	10,00	16,67
80,00	13,33	3,33	0,00	13,33	40,00	3,33	33,33
66,67	16,67	10,00	6,67	63,33	16,67	6,67	13,33
83,33	6,67	6,67	3,33	46,67	40,00	6,67	6,67

Information :

- UC : Understanding Concepts
- MKS : Misconception
- MBK : Guessing
- TMK : Not Understanding Concepts

The following graphical form of CRI result analysis on the experimental class posttest will presented Graphic 4.

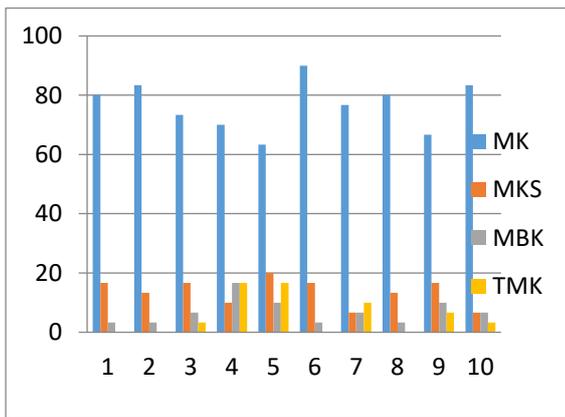


Fig. 4. Graph of Analysis of CRI Results on Posttest of Experiment Class

Based on the data in Table 1 and Graph 2 it can be described that the posttest result in the experimental class the average misconception in the experimental group that using the POE strategy was as big as 13.67% smaller than the control group that using conventional learning as big as 31.67%. As Berg mentioned that misconceptions are difficult to renew, so there

are still some concepts that are difficult for learners to understand.

IV. CONCLUSION AND SUGGESTION

Based on the research findings that communicated with operational definitions, it can be concluded that learning tools using the POE strategy have met the validity, practicality and effectiveness requirements so that feasible to use to reduce elementary student’s misconceptions on the subject of Light.

Based on the research that has been conducted, the following are some suggestions that researcher can give:

1. Teachers need to find out the difficulties experienced by students during they learning certain concepts to avoid misconceptions
2. In student-centered science learning, teachers or researchers should be more varied in using learning strategies. The strategy of POE learning on the subject of light in this research has been proven to be effective in reducing misconceptions that appeared in students. Thus, the POE learning strategy can be tried to be developed on other subject of science.
3. It’s expected that teacher can make remediation effort to overcome misconception that happened to learners in solving problem on light matter.

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