ICEE-2

"Is it True That The Soil Contains Air?" (Improving The Conceptual Understanding of 5th Graders Through POE Strategy)

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Abstract. The use of POE strategies in Indonesia has been widely developed in learning activities at junior and senior high school levels, but is still rarely used at the elementary level. Facts on the ground show that students' understanding of science concepts about air containing soil is still low. Based on this situation, this study aims to determine the increase in the ability to understand the concept that soil contains air in fifth grade students in one elementary school in Bandung. The POE strategy syntax consists of activities: predict, observe, and explain. The research design used was one group pretest posttest design. Sampling is done using non-random sampling techniques. The number of research samples consisted of 28 elementary students. Research data were collected using a four-tier diagnostic type test. Data analysis is performed by looking at the level of understanding changes by category: construction, revision, complementation, static, and disorientation. From this study, the results obtained that students tend to make improvements (revision) understanding of the concept of soil containing air after participating in learning activities with the POE strategy.

Keywords: Science conceptual understanding, POE, four-tier diagnostic, elementary education

INTRODUCTION ~ Education currently aims to shape children to adapt to society 4.0 to face the 21st-century era that is demanded to have a variety of skills such as critical thinking and problem-solving skills, leadership skills, social skills, entrepreneurial skills, analytical skills and finally have a sense of curiosity (Saavedra & Opfer, 2012). The quality of education in schools is one of the bridges for students to gain 21st-century skills. The education system, curriculum, books, and tests organized by schools follow the 21st-century era standard. Great attention is paid to skills that contribute to success in modern life such as life skills, these learning, and innovation skills, and information, media, and technology skills become an urgency to prepare all students to possess knowledge that demands innovation and creativity as competition gets stronger in the 21st-century that is increasingly past. There is little time to ensure that all current generations are ready to lead and succeed (Soule & Warrick, 2015).

Judging from the achievements of Indonesia who participated in the Trends in Mathematics and Science Study (TIMMS) from 1999, it shows that Indonesia is still in the last place. In 1999 Indonesia was ranked 34th out of 38 countries, in 2003 it was ranked 35th out of 50 countries, in 2007 it was ranked 36th out of 49 countries, and lastly, in 2015 in the field of science, Indonesia was ranked 45th out of 48 countries.

Other things that can be integrated by students when learning a concept are natural phenomena. Nature is an inseparable part of students because environmental issues are common in students where they live in urban, mountainous or coastal areas. One of them is about soil. Soil is a part of nature that is very closely related to life. One of the materials that are close to student life is about the properties of the soil. One of them is air-containing soil. In this material, students are explained how organisms in the soil that are beneficial to guard and maintain soil fertility can breathe and if there is a flood, the organisms will die and have an impact on nature. This is an effort to equip students to be more concerned about the sustainability of soil fertility.

But there are still misconceptions regarding the properties of the soil, especially regarding the nature of air-containing soil. This is a problem for students, given the concept of soil properties is very important for students as provisions for them to have a concern for the preservation of soil fertility. Also as a representation of increasing understanding of scientific concepts to improve science studies at the international level.

See the importance of two things above, then the learning process needs to be implemented with strategies that can improve and enhance students' understanding of science concepts. Then the POE strategy was chosen.

POE has a role to understand the students' conceptual understanding through the three of its' syntax which is related to each other namely predict-observe-explain (White & Gunstone, 1992).

The Predict-Observe-Explain (POE) strategy is introduced by White and Gustone which aims to reveal the ability of students to make predictions individually. The *Predict-Observe-Explain* (POE) procedure includes the students' predictions of the demonstration results, discussing the reasons for the predictions they give based on the demonstration results, and explaining the prediction results of their observations (Nurhalimah, 2015). POE's role is to help students explore and justify students' concepts themselves, especially in the prediction and reasoning stages.

Learning with the Predict-Observe-Explain (POE) strategy uses 3 main steps, namely: 1) prediction, which is a process of making guesses about an event. When students make guesses, students already know the events that occur as well as the reasons. In this process, students are not restricted but the teacher gives the widest possible freedom so that the teacher understands how the concepts of student thinking. Supriyadi (Nurhalimah, 2015) in this prediction process the teacher can also understand the misconceptions that occur in many students.

2) observation, observation is a fundamental scientific skill. Semiawan (Desstya, 2015) in observing, students use all the senses to see, hear, feel, taste and

smell. At this stage students make observations to test the predictions they express. Students observe what happens, the most important thing in this step is confirmation of their predictions.

3) explanation, which explains the suitability of predictions with experimental results with the results of the observation stage and after the students get an explanation of the truth of the predictions, the students are more confident in the concept. Students will experience a conceptual change from the concept that is not true to true.

Previous research on POE, conducted by (Sudiadnyani, Sudana, & Garminah, 2013) about the effect of POE learning on the understanding of science concepts of grade IV students, the results show there are differences in understanding the science concepts of grade IV students between groups of students who are taught using the POE learning model with groups of students who are taught using conventional models. According to the results of his research, the Predict-Observe-Explain (POE) learning model provides a better influence than conventional learning models in achieving a maximum understanding of the concept of science. So, the results of this experimental research can have positive implications, that the Predict-Observe-Explain (POE) learning model has been able to provide a new breakthrough in improving the understanding of science concepts specifically grade IV students. Next is the research conducted by (Banawi, 2019) about changes in the conception of the prospects of elementary school teachers about conditions and their changes through the predict-observe-explain strategy. The results showed that the use of POE strategies was able to increase students' understanding of the concept of the state of matter and their changes both at the macroscopic level (N-gain 0.32, p = 0.00), submicroscopic level (verbal N-gain 0.44; p = 0.00, and visual N-gain 0.49; p = 0.00), or symbolic level (N-gain 0.41; p = 0.00). Furthermore, research conducted by (Furqani, Feranie, & Winarno, 2018) about the influence of predict-observe-explain (POE) strategies on students' conceptual mastery and critical thinking in learning vibrations and waves. Based on the results of the analysis in the study, the predict-observe-explain (POE) strategy showed an increase in students' conceptual mastery, indicated by the normalized N-gain value, 0.29.

From the results of previous studies, it was found that POE is able to direct students towards a good understanding of concepts. However, research on the application of POE in improving the understanding of science concepts of fifth-grade students about soil contains air so far has never been done. Based on the description above, the purpose of this study is to find out the application of the POE strategy on improving the ability of fifth graders to understand the concept of soil, that it's containing air.

ICEE-2

METHOD

The study was conducted at one of the public elementary schools in Bandung on Friday, May 17, 2019, at even semester of the 2018/2019 school year. The research subjects consisted of 28 fifth grade students. This study used a pre-experimental research method. The research design used is the one group pretest-posttest design. The sample in this study was obtained using a non-random sampling technique.

The data collection technique was carried out using the test method to find out the understanding of students' scientific concepts. The tests given are of the four-tier diagnostic type. The test instrument was in the form of an understanding of the concept of soil containing air, a prediction sheet, and an observation worksheet. Tests are given at the time of the pretest, posttest, and during the learning process.

The study was conducted using only one class, namely the experimental class without the control class. The research activities were carried out by testing the science concept understanding tests at the time of the pretest, carrying out science learning activities using the POE strategy, and retesting the science concept understanding tests at the time of the posttest. The initial step of the science learning activities that use the POE strategy is done by asking students to work on prediction problems, then students are given the opportunity to conduct an experiment to prove that the soil contains air by using the science learning KIT to prove the predictions written on the results in an experiment worksheet. In the next step, the teacher explains and discusses with students the experiments that have been conducted.

RESULTS AND DISCUSSION

Pretest and posttest questions consist of 2 questions. Number 1 measures the ability of students to understand the concept that soil contains air. Number 2 measures the ability of students to understand the impact of air content in the soil on the environment.

The results obtained from the pretest test questions 1 can be seen in the following figure 1.

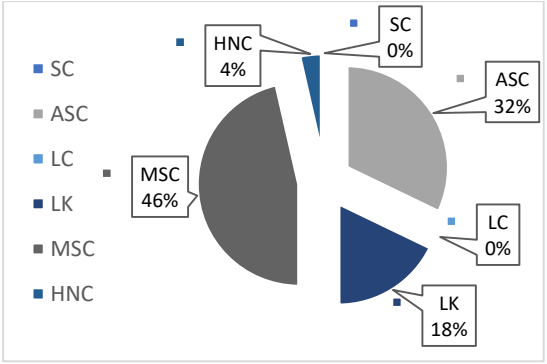

Figure 1. Percentage of Pretest Results on Number 1

Information:

Scientific Conception (SC)

Almost Scientific Conception (ASC)

Lack of Confidence (LC)

Lack of Knowledge (LK)

Misconception (MSC)

Have No Conception (HNC)

Figure 1 shows that the results of question number 1 of the pretest, students tend to experience misconceptions about the concept of soil contains air. In question number 1, about 13 students (46.42%) experienced misconceptions (MSC); about 9 students fall into the category of almost scientific conception (ASC); about 5 students (17.86%) fall into the category of lack of knowledge (LK) and; about 1 student (3.6%) falls into the category of having no conception (HNC).

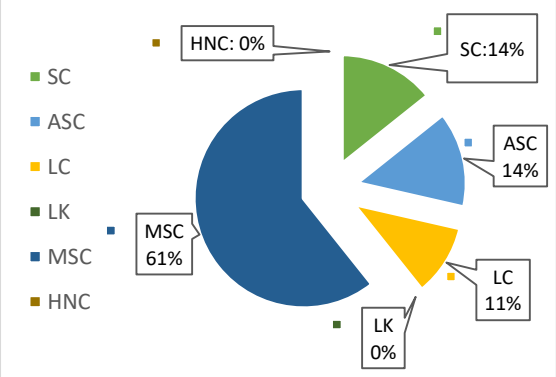

Figure 2 Percentage of Pretest Results on Number 2

Figure 2 shows that on the results of the pretest grades of question number 2, students tend to experience misconceptions regarding the impact of air content in the soil on the environment. The pretest grade number 2 shows that, around 17 students (60.71%) experienced misconceptions (MSC); around 4 students (14%) fall into the scientific conception (SC) category; about 4 students (17.86%) experienced almost scientific conception (ASC); and around 3 students (11%) fall into the category (LC).

Misconceptions that often occur in problem number 1 lie in the students assume the soil is solid and does not have a cavity so that if a piece of soil is put into the water will not appear air bubbles. This is believed by 46.42% of students. While the misconceptions that often occur in problem number 2 are students who

believe that living things that are in the ground will not die if there is a flood. This is greater than the number one, which is 60.71% of students. According to (Akbaş & Gençtürk, 2011) misconceptions occur in most mathematics and natural science material. The science concept of air containing soil can be found in soil material but is rarely discussed even though this is very close to the daily lives of students.

After students complete the pretest, students complete the prediction questions that contain the concept that the soil contains air. The achievement of the prediction problem results can be seen in Figure 3 below.

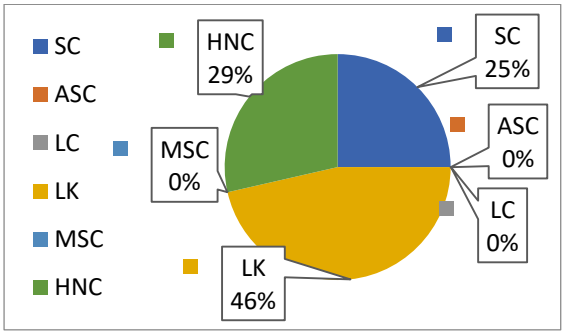

Figure 3 Percentage of Student Predictions Results

Prediction test results in figure 3 show the category proportion of "lack of knowledge (LK)" is quite large when compared with the proportion of other categories. As many as 46% of the total number of 28 students, which is about 13 students still experience a lack of conceptual knowledge about soil contains air. Unlike the prestige, at the stage of predicting students tend to be greater at the level of lack of knowledge (LK). lack of knowledge (LK) inhibits student understanding (O'Reilly, Wang, & Sabatini, 2019). Students are weak in predicting what will happen if a piece of soil is put in water. 46% of students are wrong in predicting this, explaining that the concepts students have are not yet included in scientific conceptions.

Students are allowed to conduct experiments to prove that the soil contains air by using the Science Learning KIT after students work on prediction problems. A total of 28 students took part in the learning, then divided into four groups, each consisting of seven students. After experimenting, students are given an experiment worksheet following the experiments conducted. The results can be seen in figure 4 as follows.

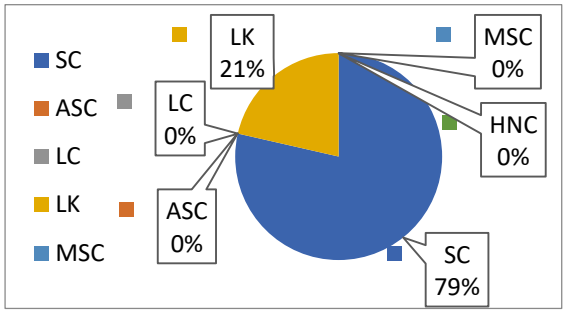

Figure 4 Summary of Settlement Results Experiment Worksheet

Figure 4 shows that the number of students experiencing lack of knowledge (LK) decreased from 48%, namely approximately 13 students, to 21%, which is approximately 6 students, and the remaining 79%, ie approximately 22 students, have mastered the scientific concept that soil contains air. According to previous research conducted by (Gkouskou & Tunnicliffe, 2014), observation provides an opportunity for students to observe science in action at certain times. Students are given the opportunity to gain direct knowledge such as learning activities with a fun Predict-Observe-Explain (POE) strategy compared to other teaching strategies (Bilen, 2016).

Students were given the same posttest questions as the pretest questions, after students answered the results of the experiment worksheets. The results can be seen from figure 5 as follows.

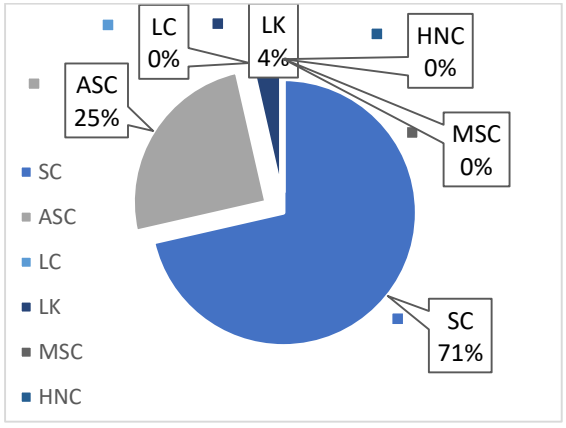

Figure 5 Percentage of Posttest Results in Number 1 (Soil Contains Air)

Figure 5 shows that the category of scientific conception (SC) is the highest category achieved by students on posttest questions. This is very different from the results of the pretest which shows that the category of misconception is the highest. About 20 students (71.42%) fall into the category of scientific conception (SC), around 7 students (25.25%) fall into the category of almost scientific conception (ASC) and about 1 person (3.57%) are included lack of knowledge (LK) category.

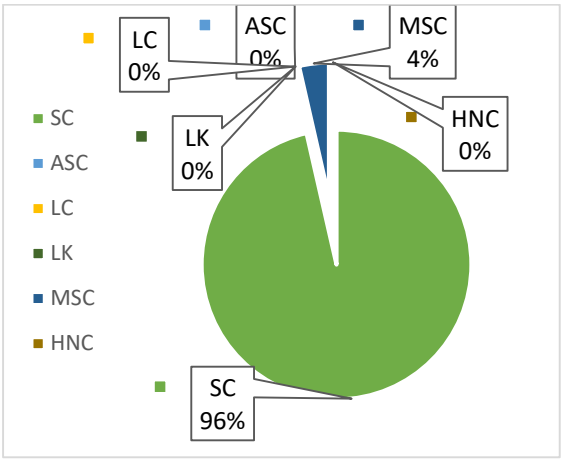

Figure 6. Percentage of Posttest Results in Number 2

(Impact of Conceptual Understanding about Soil Containing Air on Environmental Continuity)

Figure 6 shows that students who are capable of scientific conception (SC) consist of about 27 people (96.42%) and about 1 person (3.57%) experiencing misconceptions (MSC). From the results of the two questions, it can be seen that the majority of students are already at the level of scientific scientific conception. The percentage increases after students do research directly. Changes in the magnitude of the percentage proportion of each category as a whole are shown in table 1 as follows.

Table 1 Increased Percentage of Categories Understanding of Student Conceptual

Question Number / **Category**		1	2
Pretest	SC	0%	14%
	ASC	32,2%	14%
	LC	0%	11%
	LK	17,9%	0%
	MSC	46,4%	61%
	HNC	3,6%	0%
Posttest	SC	71%	96%

Category \ Question Number	1	2
ASC	25%	0%
LC	0%	0%
LK	4%	0%
MSC	0%	4%
HNC	0%	0%

Table 1 shows that students' understanding of the concept of "soil containing air" in the posttest had increased from the pretest.

The next analysis is to look at the level of change in students' conceptions. There are five levels of change from the pattern of concept change proposed by (Anam, 2019), namely: 1) construction, 2) revision, 3) complementation, 4) static, and 5) disorientation. These five levels of change will be the categories that show the level of conceptual change students have increased, remained or experienced a setback. Table 2 shows the changes in students' conceptions before and after the learning process using POE strategies.

Table 2 Explanation of the Pattern and Level of Change in Students' Conception

Change of Response		Level of conception change	Explanation
Early	**End**		
HNC	LC	*Contruc-tion*	Students are able to construct their understanding
	ASC		
	LK		
MC	LC	*Revision*	Students are able to make improvements (revisions) of the initial understanding they had
	LC		
	ASC		
	SC		
LK	LC		
	ASC		

Change of Response		Level of conception change	Explanation
Early	**End**		
	SC		
HNC	HNC	*Static*	Students cannot change their understanding into better understanding
MC	MC		
LK	LK		
LC	LC		
ASC	ASC		
Changes that occur backward from the beginning to the end category		*Disorienta-tion*	Students experience a change in understanding but the final understanding is no better than the initial understanding
ASC	SC	*Comple-mentation*	Students are able to refine their incomplete initial understanding to be more complete and in accordance with scientific conceptions

In the following figure 7 and figure 8, is the percentage of achievement level changes in the students' initial and final conception at number 1 and number 2.

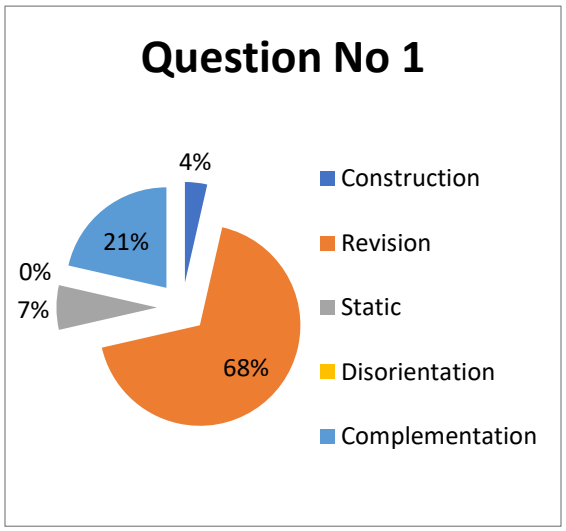

Figure 7 Percentage of Achievements in the Level of Change in Student Conception at Number 1

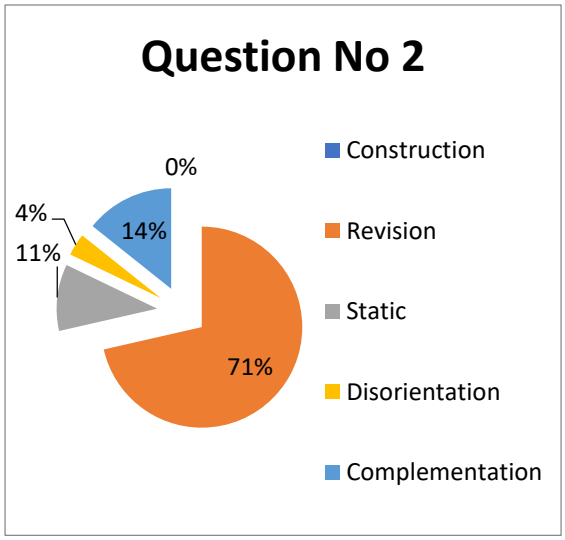

Figure 8 Percentage of Achievements in the Level of Change in Student Conception at Number 2

Based on Figure 7, problem number 1 shows that the type of students conception change have about soil containing air consists of 5 levels of change. In question number 1, there was about 1 student (4%) who experienced a construction change; around 19 students (68%) fall into the revision category; around 2 people (7%) fall into the static category; none of them fall into the disorientation category; and included in the level of complementation consisted of about 6 students (21%).

In Figure 8, in question number 2 there is no one included in the construction category; around 20 students (71%) fall into the revision category; around 3 students (11%) fall into the static category; about 1 student (4%) experienced a change in

disorientation; and included in the level of complementation consisted of about 4 students (14%).

The results of this study indicate that students' misconceptions about aerial soil can be revised. This is in line with what was stated by (Nurhalimah, 2015; Sudiadnyani et al., 2013), that POE can help students make improvements to initial conceptions that might be wrong. Students are given the opportunity to experience for themselves the truth of a concept through exploration and experimentation.

CONCLUSION

Based on an analysis of research data, the results show that students tend to make improvements (revision) regarding the understanding of the concept of soil containing air after participating in learning activities using POE strategies.

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