# Unnes Science Education Journal

# THE INFLUENCE OF PROBLEM BASED LEARNING WITH SCIENCE, ENVIROMENT, TECHNOLOGY, SOCIETY (SETS) APPROACH TO STUDENTS' PROBLEM SOLVING SKILLS AND ENVIRONMENTAL AWARENESS CHARACTER

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## Article Info

## Abstract

This research was done in SMP 4 Kudus. This research aimed to unveil the influence of problem based learning with SETS approach to students' problem-solving skills and environmental awareness. This research was a quasi-experimental research with control group design. The sampling used purposive sampling technique. The samples of this research were VII A class (experiment class) and VII B class (control class). The data were collected by using tests, observation, and self-assessment. The analysis showed that problem based learning with SETS influenced students problem-solving skills in 56.3%. Experiment class students' problem-solving skills was better than the control class proved from the t-test analysis where $t_{count} > t_{table}$. Based on the analysis of man witney test, the average score of environmental awareness in control class and experiment class known as $Z_{count}$ of 4.01 and $Z_{table}$ of 1.96. The average percentage of students' responses was 84.9% in very good category. In conclusion, problem based learning with SETS approach influences students' problem-solving skills and their environmental awareness.

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## INTRODUCTION

Education is a tool to develop every basic potential for the development of the nation. Based on Law Number 20 Year 2014 Article 1 regarding National Education System states that education is an aware and planned effort to actualize students' learning process which can actively develop themselves in spiritual ability, self-control, smart personality, noble character, and skills required for the community or the nation (Munib, 2012:144).

Efforts done for the sake of students' potential development through learning process, thereby, the learning process should have high quality by providing knowledge, skills, implementation of science, and education management. In achieving the goal of education, there should be a curriculum. Curriculum applied in Indonesia is KTSP curriculum.

Based on Mardiana (2016), KTSP is a fulfillment of Law Number 20 year 2014 regarding National Education Standard and Indonesian Government Regulation Number 13 year 2015 regarding National Education Standard through Regulation of Ministry of Education number 22, 23, and 24 year 2006. This curriculum insists the changes in education and learning, especially formal education. The changes should follow the learning process of the school.

Actually, current learning process is not in line with KTSP, especially for science education. Based on the observation of SMP 4 Kudus, the method of learning process still used lecturing. It influenced the students negatively that the teaching became less optimum. Lecture in SMP 4 Kudus only emphasized on science and understanding to the materials. Teachers only gave exercises in students' worksheet. It makes the students had less ability in developing critical skills and problem solving as well as unable to apply the theoretical concept in the class in the real life.

Beside lecturing, teacher also uses practicum. One of the materials of science which uses practicum in environmental pollution. Learning process in environmental pollution used practicum method, yet teachers have not developed the existing learning process; for example, students did practicum to know the influence of detergent water to fish. This practicum did not demand the students to think critically; thereby, students only did the practicum without knowing the solution to certain problems. Moreover, it is worsened that the teacher did not give students chances to make conclusion, since the learning process was teacher-centered. Thus, the students became passive and only hear the explanation form the teachers. It made the students had low ability of problem-solving.

Based on the interview to teachers, students' problem-solving skills was relatively slow. According to Wena (2014), basically, the goal of learning process is producing students who have knowledge and skills in solving problems in the society. In conclusion, problem solving is very important for students.

An effort which is needed to handle the problem is there should be a creativity of teachers to empower students' problem-solving skills. Along with the development of education, teachers are demanded to improve the learning process by using active, creative, elective, and fun learning for students. An important factor of achieving it is through the choice of learning method.

A learning model which can be applied by teacher is Problem Based Learning (PBL). PBL is an approach of learning using the real-life problems as a context for students about critical thinking and skills to solve problem as well as to get the understanding and the concept of learning materials (Nafiah. 2014).

Materials of science for Junior High School students which can be applied with PBL is environmental pollution. Environmental pollution is the most recent happening which is known by students in their daily life since they tend to interact with their surrounding. Based on the observation in SMP 4 Kudus, students' environmental awareness is still slow. It is seen from their behavior of littering everywhere, instead of throwing it to organic and inorganic dump. Meanwhile, school has prepared garbage in each corner. SMP 4 Kudus is an *adiwiyata* school which entitles the school with environmental culture along with the indicators of environmentally friendly regulation. Ideally, all school members should have the culture of cleanliness and healthy life. However, some indicators have not been achieved, since there is low awareness from students to school environment. Therefore, a character education of environmental awareness is urgent to be done.

Based on the background, a research entitled "The implementation of Problem Based Learning (PBL) with SETS approach to improve students' problem-solving skills and environmental awareness in the material of environment".

## METHODS

This research used quasi-experimental design with nonequivalent control group design (Sugiyono, 2012: 116).
Figure 1. The Design Nonequivalent Control Group
The population of this research was the VII grade



| Kelas Eksperimen | O1 | X | O2 |
| Kelas Kontrol | O3 | Y | O4 |
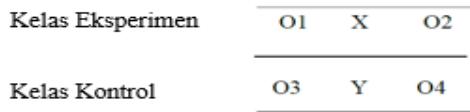
students of SMP 4 Kudus from VIIA-VIIG. The sample was determined with purposive sampling which obtained VII A class as the experiment class and VII B as the control class. It is based on the consideration of students' learning outcome which was relatively the same, and both class are also taught by the same teacher. The independent variable in this research was the use of problem based learning with SETS while the dependent variable was the problem-solving ability and character of environmental awareness.

The data of this research were obtained through test, observation, and questionnaires. The instruments to obtain the data were problem-solving test, self-assessment test, and observation sheet. The data of problem-solving were obtained through posttest and pretest. The tests were in multiple choice to analyze the ability of problem-solving before and after the treatment. The observation was done in four times.

The analysis of the data used normality test, homogeneity test, and biserial correlation test to know the influence of the influence of the subject to students problem-solving skills. An influence significance test was done to know whether there is an influence to students' problem-solving skills. Mann witney test was also done to know the difference between experiment class and control class. The analysis was done quantitatively and descriptively. Descriptive analysis was done to describe the progress of the students in each meeting. The syntax of PBL with SETS is presented in Figure 1.

## RESULTS AND DISCUSSION

The result of this research included the data of students' problem-solving skills and environmental awareness. The analysis of students' problem-solving skills used homogeneity test to experiment class and control class. Homogeneity tests was objected to know the variance of both classes. The homogeneity test result can be seen in Table 1.

**Table 1.** Homogeneity Test of Students' Problem Solving Skills

| Data | Class | $F_{count}$ | $F_{table}$ | Criteria |
|---|---|---|---|---|
| Problem-solving skills | Experiment and Control | 0.76 | 1.32 | Homogenous |

The analysis showed an $F_{count}$ of 0.76 while $F_{table}$ was 1.32. It means, $F_{count} < F_{table}$, thereby, it can be concluded that the variance of both classes is the same or homogenous. Normality test was used to know the distribution of the data. The data of normality test to problem-solving skills can be seen in Table 2.

**Table 2.** Normality Test of Students' Problem Solving Skills

| Classes | $\chi^2_{count}$ | $\chi^2_{table}$ | Criteria |
|---|---|---|---|
| Experiment | 4.64 | 11.07 | Normal |
| Control | 6.09 | 11.07 | Normal |

Based on Table 2, $\chi^2_{count} < \chi^2_{table}$. Thus, the measurement showed that the data of both classes had normal distribution. Therefore, it can be analyzed using parametric statistics. Correlation test was done to know the influence of the subject to both classes before and after the treatments. The data of correlation tests is presented in Table 3.

**Table 3.** The Result of Correlation Tests to Students' Problem-Solving Skills

| Class | N | Average Pretest Score | Average Posttest Score | r | $t_{count}$ | $t_{table}$ | BC |
|---|---|---|---|---|---|---|---|
| Experiment | 36 | 48 | 82 | 0.75 | 10.89 | 1.67 | 56.3% |
| Control | 35 | 50.4 | 74 | | | | |

The score of coefficient correlation obtained 0.75 in the index of 0.66 to 0.79. This result showed that the degree of problem based learning with SETS to improve environmental pollution was high. The test of coefficient correlation with t test obtained the $t_{table}$ with the significance of 5% and Dk = 60 resulting 1.671, while $t_{count}$ was 10.89. Based on the analysis, $t_{count} > t_{table}$, thereby, it can be concluded that there is an influence of problem based learning with SETS approach to students' problem-solving skills. The recap of this indicator can be seen in Table 4.
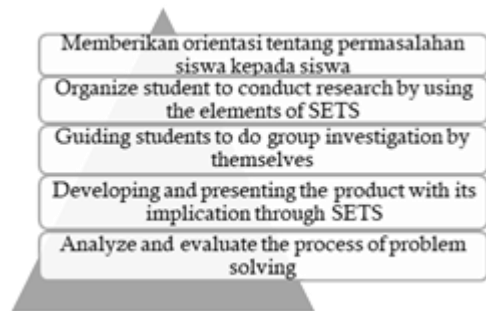


**Figure 1.** Syntax of PBL with SETS

**Table 4.** Recapitulation of Students' Problem-solving Skills

| Indicator of Students' Problem-solving Skills | Pre test | | Posttest | |
|---|---|---|---|---|
| | E (%) | K (%) | E (%) | K (%) |
| Understanding Problems | 55.2 | 51 | 89.8 | 84.9 |
| Choosing Solution | 49 | 47 | 87 | 72.4 |
| Communicating Solution | 50.2 | 44 | 75.6 | 63.1 |

Based on the pretest and posttest, students in the experiment class had higher problems in understanding problems, choosing solution, and communicating solution than the control class. The observation sheet used the minimum range of 1 to 4 in each point. The result is presented in graphic. The percentage of each indicator of problem-solving skills in experiment class can be seen in Figure 2.
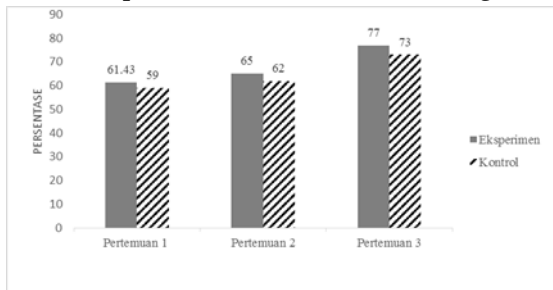


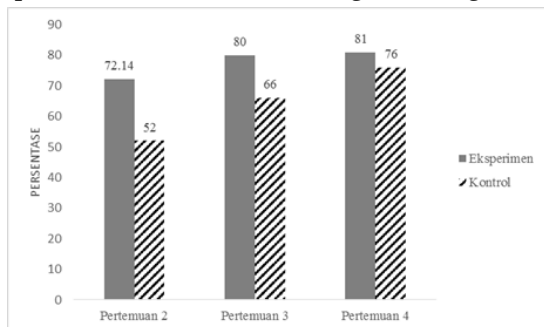**Figure 2.** The Comparison of Indicator of Problem-solving Skills

Figure 2 showed that there was a difference between experiment class and control class in understanding problems In three observation times in experiment class, the meeting 1 was fair and the meeting 2 was good. In details, it was good in the terms of understanding problems. The success of this indicator was shown by the students' ability to understand problems and had the reasons to support their argument. The experiment class had higher improvement to control class. However, both classes were in high criterion. The percentage of increase of experiment class' pretest and posttest score was also different. It is because the experiment class used PBL model with SETS where the learning process was done contextually to know the real problems.

A test item which contains the indicator of understanding problem is involving the students to explain the causes of pollution in river. The experiment class students were better in providing the analysis of their argument regarding the causes and the impact of river pollution. Nevertheless, some students in control class had less understanding to the causes of river pollution.

The ability of understanding problems will ease the students in providing argument to multiple choice question with reasoning column. Figure 1 showed that students ability to understand problem in experiment class or control class experienced improvement in every meeting. The improvement of experiment class can be categorized as good. It happened due to teachers' strategy in using problem based learnig with SETS using contextual problems of environmental problems in Kudus. It gave the students opportunities to understand problems given by their teachers. The problems were related to students' daily life that eased them to understand and find the solution for it. It supports Kuzgun (in Ozgur, 2012) that problem-solving depended on the determination or understanding of problems correctly.

The improvement of control class was different to experiment class. The control class' improvement was deemed as fair with lower percentage to experiment class. It is because the class used conventional learning where the teaching process was teacher-centered. Therefore, the students were tended to be passive and only obtained the information by

lecture. Besides, the learning also emphasized on the memorization of certain concept. The use of learning media was also unable to improve students' activeness in the classroom. Students only used learning materials from the textbook. It causes the less understanding of the materials. This result is the same to Wilujeng (2013), saying that the learning process which only emphasizes on memorization of concept which can make a knowledge meaningless.



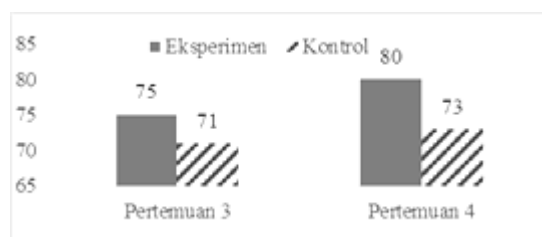**Figure 3.** The Comparison of Indicator of Choosing Solution

Figure 3 showed the difference between experiment class and control class in choosing solution. The experiment class obtained the higher score in three times of observation than the control class. In meeting 1 and 2, experiment class was in good criterion, and in meeting 3, the class improved to very good. The control class was in fair category in meeting 1 and improved to fairly good in meeting 2 and 3. The difference of improvement were not significant in experiment class, yet it was very significant in control class. Experiment class obtained higher score than control class. It showed that the ability to choose solution in experiment class was higher than the control class.

The second indicator was choosing solution. This indicator trained the students to be active in the discussion and find solution by choosing relevant information to the materials. Table 4 showed that the experiment class experienced high improvement while the control class had the medium one. A test item which contained this indicator is related to government's program to minimize air pollution and general pollution by reforestation. Students in experiment class were able to answer the question and related that it to photosynthesis of tree and plants. The ability of choosing solution will ease the students in giving answer in multiple choice questions. Figure 2 showed that students' ability of choosing solution happened in both class in every meeting. The success of this indicator can be seen from students'

effectiveness in doing discussion with their friends. Besides, students were able to choose relevant information regarding the materials. This is in line with Rachmawati (2015) that PBL only makes the students learn to find valid information.

The improvement in both class happened insignificantly. However, the experiment class had higher score than the control class. It is because the control class had less active discussion. Some students only depended on the answer of their friends and did not participate in the discussion. Meanwhile, the experiment class had active students. Their activeness in discussion really influenced their development of problem-solving skills, making them able to choose the proper solution. In Wilujeng (2013), group discussion trained the students to be discipline in learning process and give opinion to other people to solve a problem. Aslan (2012) opines that the development of problem-solving skills is objected to rational thinking and decision making process.

Students did discussion regarding contextual problems. In this case, students should be trained to solve problems in contextual concept, thereby, it can improve students' ability. Murtiani *et al.,* (2012) explains that learning activities with a correlation of learning content to surrounding environment will make a meaningful learning process.



**Figure 4.** Comparison of Indicator of Communicating Solution

Figure 4 showed that there was a significant difference between experiment and control class in terms of communicating solution. Twice observation was done to experiment class and control class. Both classes were in good criteria, yet the experiment class had higher score than the control one. It showed that experiment class students had higher ability in communicating solution than control class students.

In communicating solution, the data in Table 4 showed that experiment class had high criteria while the control class was medium. The test item containing this indicator was related to problems of dumps in Kudus by showing table of trash types in 2016. The most wasted trash was organic trash. The students were asked to provide solution to handle the trash with relevant reason. The success of this indicator can be seen in through students' ability of presenting and communicating their discussion and answering questions of the learning process. The experiment class showed better percentage comparing to control class, since the students in experiment class were able to communicate better solution than control class. According to Husna (2013), students who are able to communicate well can solve a problem successfully. Based on Redhana (2012), when the students present the solution of problems in front of the class, they also understand the material deeper. Students in the experiment class has been trained to develop the ability of problem-solving that the discussion were explained seriously with clear statements.

The observation to experiment class and control class showed that the ability of problem-solving improved in every meeting. It showed that the ability can develop along with the habituation. It is the same with Intan *et al.,* (2016) that the ability of problem-solving appeared due to continuous process of learning. Ristiasari (2012) also showed that students' problem-solving ability also able to make the learning process more effective and able to make students had critical thinking ability.

Students did an observation to problems as well as collect, analyze, and arrange arguments related to problem-solving. Then, students can relate the connection of science, environment, technology and society. It is supported by Tessarani (2016), that SETS is objected to make the students able to solve problems in their daily life. Sugiarto (2015) says that problem based learning with SETS can develop students' problem-solving skills. Students are able to directly observe problems, collect data, analyze the data, arrange an argument for solution, and discover the solution. Then, the students can relate their argument with science, environment, technology, and society.

The result of scoring to students' environmental awareness in control class and experiment class in the self-assessment can be seen in Table 5.

**Table 5.** Percentage of Students' Environmental Awareness in Each Indicator

| No. | Indicators | Percentage (%) | |
| --- | --- | --- | --- |
| | | Experiment | Control |
| 1 | Receive | 77.7 | 73 |
| 2 | Response | 85.8 | 73.21 |
| 3 | Appreciate | 78.8 | 72.5 |
| 4 | Self-Regulation | 74.2 | 68.2 |
| 5 | Habituate | 78.6 | 65.3 |
| Average Score | | 79.4 | 70.3 |
| Criteria | | Good | Good |

The analysis of students' environmental awareness in Table 5 showed that the students in experiment class had higher score than the control class. It means, the experiment class was better with higher score in every indicator than the control class. The data of the observation resulted the average score of 73% in experiment class and 56% in the control class. The comparison of percentage to experiment and control class can be seen in Figure 5.
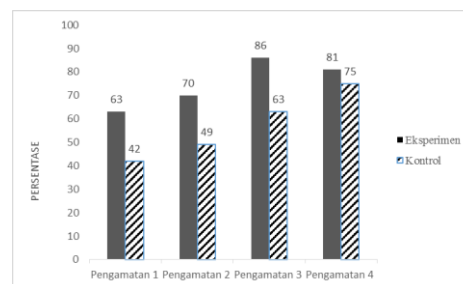
**Figure 5.** Observation of Environmental Awareness

Based on the observation, the students in the experiment class had higher awareness to the environment; for example, the students tend to throw a rubbish which is littered into a garbage.

The experiment class had higher percentage than the control class. The class directly observes the pollution of a river which fully contained waste and trashes, causing bad smell. From the information, the students in the experiment class know the impact of littering. It raised their awareness to the environment. It is in line with Kresnawati (2013), that environmental awareness can be raised with the stimulants around the students.

Students can apply what they know to avoid environmental problems. In the materials of environmental pollution, teacher explains the

materials of characteristics of trash or wastes and their impact to the environment. Then, the students will know the way to manage wastes to avoid pollution. It impacted the behavior of the students to raise their awareness. They can separate organic and inorganic waste which raised students' appreciation to the environment by always maintaining the cleanliness of the class and school, conserving plants, and watering plants every day.

Based on the observation of environmental awareness, Table 5 showed that the experiment class had higher percentage than the control class. It is because the experiment class used contextual learning to observe pollution directly. The awareness of the students in the class was higher than the control class which observed through picture. It is in line with Rimadhani (2015) that learning process with direct observation can influence students' environmental awareness.

In the learning process, teacher presented the problems of environment and the students observed that through worksheet which is based on SETS. By using PBL with SETS, students can see and feel the pollution in the environment and find solution to solve the problems. Based on the research, teacher involved the students in environment-based learning with direct observation. The awareness of the students to the environment will be higher than the students who only have a classroom-based activity. According to Izzati (2013), learning with the presentation of current problems in the environment can improve students' awareness to the environment.

Kusuma, *et al* (2016) also explained that PBL excelled as a learning model to make the students understand the learning process, challenge their ability, enhance the learning activities, as well as develop students' ability to solve problems in their surrounding environment. Thus, the students will be able to apply their knowledge to their daily life. It supports Taufiq (2014) that through science, people can have different perspective and ecological knowledge that moves their behavior and lifestyle. Besides, Mardiana *et al* (2016) says that PBL is a model which can improve students' environmental awareness. Students will have the ability to solve problems that will be useful to solve the problems in their environment.

In conclusion, PBL with SETS had positive influence to students' problem-solving skills and environmental awareness than conventional learning. The obstacle of the learning process was only on the conditioning. Since, the class was done outside of the class, which automatically made the condition uncontrolled. Besides, the students have not been accustomed to orientation of problems, since the students were used to conventional learning.

## CONCLUSION

From the research, problem based learning with SETS positively influenced students problem-solving skills and environmental awareness.

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