Understanding Skill of Junior High School Students on Environmental Pollution Topic by Environmental-based Science Learning

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Abstract: This study aims to describe the understanding of junior high school through the application of an environment-based learning approach to the material of environmental problems. The method refers to students' understanding of three indicators (translation, interpretation, and extrapolation). The subject was determined by purposive sampling of 63 students from three junior high schools in the city of Bengkulu, Indonesia. The collection technique is essay test. The results of the study are: (1) the ability to translate student translation 74 (Good), interpretation of 71 (good), and extrapolation 83 (very good), (2) the percentage of three indicators of student understanding, namely 37% translation, interpretation 31%, and 32% extrapolation, (3) the overall level of student understanding is 14%, both 68% and very good 18%. The understanding can be categorized as good in ecosystem learning. The conclusion of this study that learning with an environmental approach has a positive impact on understanding junior high school students.

Keywords: Understanding; Environmental pollution; Environmental base learning.

1. Introduction

The development of Science and Technology has had a positive and negative impact on environmental conditions. Positive impacts of science and technology for the environment include the application of biotechnology products to save biodiversity, and environmental bio-remediation techniques due to pollution. The negative impacts of the development of science and technology on the environment include decreasing environmental quality due to pollution of industrial waste and uncontrolled use of chemicals. Pollution that occurs in the environment has a very broad influence on ecosystem sustainability. The problem of environmental pollution is not enough to only be solved technically, but it needs to be approached through education. Instilling awareness that human’s part of the ecosystem that plays a role in maintaining environmental balance is very important to be conveyed in the education process. Providing understanding and changing views, and the mental attitude of students is a very important part of learning. An understanding of the role of humans in the ecosystem, needs to be invested early in students through appropriate learning strategies.

By Bloom in [1], Understanding is the ability to capture the meaning of a concept and be able to explain precisely. Understanding is divided into three dimensions; (1) Translation, (2) Interpretation, and (3) Extrapolation. Translation is the ability to translate from every one he understands. The ability to translate is indicated by a person's ability to communicate terms with different sentences, but does not eliminate meaning. Interpretation is the ability to interpret the meaning of a phenomenon or fact based
on concepts understood. Extrapolation ability to predict or make predictions about trends that occur based on facts and situations found. The ideas presented contain original thoughts and are based on the concepts he has known. The cognitive process in the category of understanding includes: (1) interpreting; (2) exemplifying; (3) classifying; (4) summarizing; (5) concluding; (6) comparing; and (7) explaining learning [2]. The understanding of students is defined as construction the meaning of instructional message including oral, write and graphic communication [3]. Based on this explanation, a person is categorized as understanding a concept, if he is able to construct his knowledge and convey it verbally and in writing as outlined in a sentence structure or picture.

Understanding of pollution is the ability to capture meaning about the concepts of environmental pollution. The ability to translate and interpret facts and phenomena regarding environmental pollution, predicts the effects that occur due to pollution to ecosystem damage. Understanding the relationship between humans and the environment is a very important part to be taught to students. In an effort to provide an understanding of students about environmental concepts required a science learning strategy that is arranged systematically by utilizing the environment as a learning resource. Environmental-based science learning is a learning strategy by utilizing the surrounding natural environment as a learning resource. The natural environment can help teachers present contextual and more meaningful learning for students. Learning activities that provide meaningful learning and learning experiences will develop students' cognitive, affective, psycho-motor abilities [4] [5], critical thinking skills and foster a positive paradigm for students towards the environment [6] [7]. Learning strategies by showing natural phenomena that occur around the environment are quite effective in developing logical thinking, understanding concepts, and instilling spiritual values in junior high school students [8] [9]. Exploration of the natural environment around the science learning process encourages student performance in observing, analyzing data, and inference [6] [10]. Referring to the results of research, science learning with a scientific approach encourages students to actively learn, grow positive attitudes, and develop students' psycho-motor skills.

The development of environmentally oriented science learning provides learning experiences that can develop science process skills and help self-instructional students. In the learning process, students are directed to understand the environment by introducing environmental conditions, observing environmental problems and issues, and addressing the problem appropriately. The science learning strategy with an environmental approach is expected to improve understanding, develop a paradigm, and form a positive attitude towards the environment.

The rest of this paper is organized as follow: Section 2 describes the related works. Section 3 presents the data used and proposed method. Section 4 presents obtained results and following by discussion. Finally, Section 5 concludes this work.

2. Related Works

Education facilitates students to improve themselves through systematic activities. There are three elements in education that are of concern, namely objectives, assessment and instructional strategies [11]. Thus, the development of education is carried out on these three elements to improve the quality of education. One of the objectives of education is to improve students' understanding abilities.

2.1. Overview of Understanding

Understanding is an ability needed by students to understand and understand the concept of a particular material [3]. Good understanding ability will support the development of higher levels of advanced thinking. To this, efforts to improve understanding skills have not been done much in learning. In fact, a child will have good learning outcomes if the ability of understanding has been developed.
2.2. Dimension of Understanding Skill
Understanding has 3 dimensions, namely (1) Translation, (2) Interpretation, and (3) Extrapolation, by Bloom in [1]. Cognitive processes in the understanding category include (1) interpreting, (2) modeling, (3) classifying, (4) summarizing, (5) concluding, (6) comparing, (7) explaining learning [2]. The level comprehension of students supports to master the skills of the century. Competencies that must be mastered by students for 21st century life. Competence of 21st are communication, collaboration, critical thinking, creativity [16]. The function of 21st century skills is to support students to live life in the 21st century. Critical thinking skills are based on students' understanding abilities. One of the 21st century skills that is directly concerned with understanding that is critical thinking.

2.3. Understanding Skill on Environmental Concept
One understanding ability is about understanding the environment. Understanding the environment is the ability to understand the concept concepts of environmental problems. This ability has the characteristics of being able to translate and interpret facts and phenomena related to environmental problems and predict the effects caused to the ecosystem. There is not much research on the ability to understand the environment. Understanding skills can be developed through planned learning. The development of learning carried out is a type of delivery manipulation (verbal or non-verbal) [11] and learning strategies. Development of understanding skills about environmental conception by IEI (Introduction, exploration, interpretation) models [5] (see Figure 1).

![Figure 1. Steps of IEI learning by utilizing the environment as a learning resource](image)

3. Material and Proposed Method
This research is a Research and Development which refers to ADDIE models. Which consists of five main stages: Analysis, Design and Development and Production, Implementation and Evaluation [12]. The initial step of the research is to conduct a needs analysis by exploring the potential of the environment as a learning resource, and identifying basic competencies and analysis of learning material based on the junior high school curriculum. Learning scenario design, student worksheets (teaching materials) that refer to the junior high school curriculum and environmental potential as learning resources. Development and Production of learning devices; implementation plan of learning and student worksheets about environmental pollution that occur around students. Learning devices are validated by 2 experts and 3 teachers (practitioners). The implementation of teaching materials was carried out in three Bengkulu City Junior High Schools with 62 students. Evaluation is done by measuring student learning outcomes as an indicator of the achievement of environmental-based science learning. The understanding of the concept of pollution. The comprehension criteria consist of five categories as following:
40 < X ≤ 54 : Less
X ≤ 39 : Very Less

The instrument used is an essay problem which consists of indicators of the process of cognitive translation, inference, and interpretation. Students’ understanding of the concept of environmental pollution was analyzed descriptively.

4. Results and Discussion

The results of needs analysis refer to the phenomena that occur and instructional objectives, so the teaching material is composed which consists of learning scenarios, student worksheets, and assessment instruments. Phenomena found in the surrounding environment include temporary disposal sites and river pollution. Achievement of learning outcomes is that students are able to (1) analyze the occurrence of environmental pollution, causes, and impacts on the ecosystem, (2) have ideas and alternative solutions to solving environmental pollution problems conceptually based on observations (see Figure 2).

![Figure 2](Source: Olivia document)

Figure 2. Environmental conditions a) Piles of household waste and b) River polluted by factory waste

The developed learning scenario refers to environment-based learning using the IEI learning model with 3 stages, namely Introduction, Exploration, and Interpretation [5]. Learning is designed in two meetings. The first meeting explored the students’ initial knowledge related to environmental pollution phenomena and observation techniques on environmental pollution. The second meeting, learning was designed with experimental methods about the impact of water and soil pollution on the lives of organisms. Students are assigned to formulate ideas in dealing with pollution that occurs in their environment. The principles of learning carried out in line with the view of constructivism, which explains that knowledge is built by students themselves both personally and social [13]. In that learning, students actively construct the concept of pollution and alternative solutions in solving environmental problems conceptually. The learning model conducted is expected to improve students' understanding more comprehensively.

Completeness of teaching materials is supported by student worksheets to help students while conducting experimental activities. The worksheet framework developed contains five main elements,
namely, identity, competence, learning objectives, concept maps, and activity material. Identity contains information on environmental pollution material as subject matter studied. The competency of learning outcomes to be achieved refers to the results of curriculum analysis. Learning objectives are learning outcomes based on indicators that will be achieved. Concept maps that are presented contain important concept concepts that must be understood by students. The material for student activity sheets that was developed included two activities, namely the pollution case study about pollution that occurred in the environment around the students and the impact of pollution on the life of the organism. Activities in student worksheets are oriented to the problem based learning model. The environmental problems presented in the worksheet are expected to develop students' understanding of environmental pollution and conceptually alternative solutions to environmental problems.

The implementation results show students' understanding of environmental pollution material including good categories. Distribution of students' understanding in each category: very good 18%, both 68%, and quite 14%. Learning science with an environmental approach through the IEI learning model encourages students to understand the concept of pollution based on the results of observations and experiments conducted at the exploration stage which are shown in Figures 3 and 4.

Figure 3. framework of student work sheet pattern problem solving

Figure 4. Category of understanding of students of Bengkulu City Middle School regarding environmental pollution in science learning with an environmental approach

Learning strategies by utilizing the environment as learning resources describe the discovery-inquiry process. Exploration steps in learning encourage students to be actively involved in finding important concepts. In these exploration activities students are directed to understand environmental pollution by observing the phenomena that occur. The activity also trains students' ability to think critically in
analyzing pollution problems that occur in the environment [6]. Learning strategies developed can help students to construct meaning and interpret, and draw conclusions inductively-deductively. Students' understanding of the concept of pollution and the impact on the environment is measured based on three indicators of cognitive processes; translation ability, interpretation, and inference. In general, the ability to understand the three indicators is a good category (77.15), the average value of students' translation ability reaches 76.25, the average inheritance ability reaches 84.50, and the average interpretation ability reaches 71.25. The average value of the understanding process of the three indicators can be seen in the following graph in Figure 5 below.

![Figure 5. Translation ability, interpretation and inference of school students downs the first city of Bengkulu in science learning with an environmental approach](image)

Translation ability is the ability of students to compose the original sentence into a new sentence form based on their understanding [3]. The translation ability of students referred to from the learning outcomes is the ability to classify with examples of pollution based on observations and provide argumentative explanations. The ability of translation to develop when students observe objects about pollution phenomena that occur in their environment. In the observation activity students try to translate the findings data and give meaning based on their knowledge.

Inference ability is the process of finding patterns in abstracting an important concept or principle and drawing the relationship between the concept concepts. Ability in inference is indicated by the ability to draw conclusions and predict based on the results of experiments or observations. Cognitive processes that students are able to draw conclusions based on observations about the kinds of pollution and the impact of pollution on the sustainability of ecosystems, as well as alternative solutions in solving environmental problems conceptually.

The ability to interpret is the ability to change information from one form to another. Cognitive process is shown by interpreting pictures and numbers into a sentence or vice-versa from a sentence into an image or numbers in the form of a table [3]. Interpretation ability develops when students interpret the information obtained and provide arguments for the explanation presented. This activity occurs at the processing and verification stage regarding the types and impacts of pollution on the environment.

The ability of understanding can be developed through learning activities that carry out observation, investigation, and analysis. Observation activities in learning train students to have curiosity, open thinking, and sensitivity to environmental problems [14]. The process of inquiry in learning is a learning strategy that can improve performance and positive behavior towards subject matter [15].
learning with an environmental approach was developed to present contextual teaching material. Exploration activities carried out motivate students to observe environmental phenomena and overcome environmental problems that occur in the surrounding environment. The offer of contextual learning material can develop analytical skills, reasoning power, logical thinking, abstraction, applicable, and able to internalize concepts through the discovery process [16]. Referring to student learning outcomes shows that science learning with an environmental approach that presents teaching material contextually can improve understanding of the concept of environmental pollution.

5. Conclusion

The results of student learning outcomes achieved at good category in environmental-based science learning in Bengkulu City Middle School where the average student comfort in analyzing the impact of environmental pollution and the idea of solving environmental pollution problems are conceptually. The distribution of student understanding in each category is very good 18%, both 68%, and quite 14%. Categories of understanding get good category for indicator of translation, interpretation and inference. The highest score on comprehension ability (84.50) in the inference indicator is the ability to draw conclusions based on observations about the types of pollution and the impact of pollution on the environment. The lowest score (71.25) is an interpretation indicator that is the ability to interpret data in the form of pictures or tables and provide an argumentative explanation appropriately.

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