Impact of outdoor learning by step Introduction, Exploration, and Interpretation (IEI) based on environment on students’ critical thinking

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Abstract. Research on development of IEI (Introduction, Exploration, and Interpretation) learning model for Natural Science base on conservation area in Bengkulu University has been conducted. The purpose of this study was to describe the impact of IEI learning model on students’ critical thinking skill. Research and Development method was conducted. It included four stages of activities: (1) The needs of analysis, (2) observation a learning resource from the ecological aspects of conservation area, and (3) instructional design based on conservation area for secondary school students. 15 students from secondary school at Bengkulu city and 15 students from secondary school at a district of Bengkulu province were involved in this study. A fifth indicator of critical thinking was used to describe the impact of IEI on students’ critical thinking skill, include: giving simple explanation, identification, translation, constructing argument, giving conclusion. The results show 56.7% students have critical thinking skill. There is no significant difference of critical thinking skill between students from district and capital city. There is also no significant difference based on gender. Allegedly, each step of IEI supports student’s critical thinking skill. It can be concluded that IEI have a positive impact on critical thinking skills.

1. Introduction

Bengkulu University has established a conservation area for numerous native organisms including plants and animals on campus. It is potential to give contribution in learning science process based on environmental. Environmental education for science learning in Indonesia has been advanced. Conservation area on Bengkulu University has some benefit and aims as follow: 1) to support teaching and learning process especially for biology learning, 2) to facilitate implementation of research and science expansion beneath Natural Conservation Education, 3) to bring out community service to reinforce the insight of Natural Conservation Education, 4) to bring out the Green Teacher, Teaching Green, Green School. Conservation area facilitates biology learning activity outright conducting research for students from elementary, secondary, and university levels [1, 2].
Numerous concepts of biology related directly to the environment. An ecosystem embraces all of the living things (plants, animals, and organisms) in an area, interrelating with each other, and also with their non-living environments (weather, atmosphere, climate, earth, sun, soil). Characteristic of ecosystem concept indicates that outdoor science learning based around the environment relevant to develop for biology as a part of science branch. Sample of ecosystem can be seen.

![Ecosystem as a concept in biology (source: perpusku.com)](image)

Figure 1 shows that concepts of ecosystem strongly related to the environment. It indicates that outdoor learning model compatible to learn ecosystem concepts. Conservation area on campus of Bengkulu University is potential to support outdoor learning model compatible to learn ecosystem concepts.

The learning process by making use of the natural environment provides an opportunity for students to actualize the ability in various forms of skills in observing, clarifying, predicting, measuring, summarizing, and communicating as the basic skills of a scientific process and the ability of science [3]. The learning process based on natural environment also potentially to train the ability of thinking critically. One of the capabilities targeted in the 21st century is the ability to think critically. Another competencies of the 21st Century are critical thinking skills and problem solving skills, skills and collaboration communication, creativity and innovation skills, literacy of information and communication technologies, contextual learning skills, information and media literacy skills [4].

The advantage of the environment as a source of learning is very important in supporting the process of student development as a whole because it can involve all aspects of cognitive, affective, and psychomotor of student. Student involvement with nature during the teaching and learning process will provide the experience and optimal learning results and in still a love of nature around [1]. A learning model based on environmental has been developed. It conservation area for several local plants and animals on campus of Bengkulu University are helpful to support learning model based on environmental around. The learning model developed was namely IEI (Introduction, Exploration, and Interpretation). IEI expected to facilitate student’s critical thinking through outdoor learning activity for teaching science.

### 2. Experimental Method

This research referred to Research and Development method [5, 6]. In general, the steps of development are (1) review the curriculum for science subjects, (2) observe the ecological aspects of conservation area as a learning resource, and (3) design instructional based on the conservation area for secondary school students, and (4) limited trial on two middle schools namely SMPN 1 Ujang Mas Kepahyang District and SMPN 11 Kota Bengkulu, with the numbers of students each class are 15 students. The lesson is done through two phases, namely the first phase, held in the classroom (indoor)
to provide an introduction and to look the initial knowledge about the concept of ecosystems and the diversity of living things. The second phase held at outside classroom which on exploration activities, namely observations ecological aspects in the conservation area.

Parameters of students’ achievement that were measured in this study were the ability of students’ thinking critically. The criteria of critical thinking are classified as follow:

| X         | Criteria          |
|-----------|-------------------|
| 80 < X ≤ 100 | Very Critical     |
| 60 < X ≤ 80  | Critical          |
| 40 < X ≤ 60  | Quite Critical    |
| 20 < X ≤ 40  | Less Critical     |
| X ≤ 20       | Not Critical      |

X: students’ score of critical thinking skill test.

The instruments that were used to measure students’ critical thinking skills is written test. The data of the research were analysed using descriptive analysing. The findings in the lesson were used as materials for evaluation and revision of the development of IEI learning model. The instrument had been validated by 2 experts 3 practices (teachers) and had been tested to 15 participants. The result shows that the instrument is valid and reliable to use it this research.

3. Result and Discussion

The results show that the impact of IEI learning model in both schools specifies that student’s critical thinking skills as follow: 3.3% of total students is at low critical, 23.3% is at quite critical, 56.7% is at critical, and 16.7% is at very critical. Figure 2 shows that most of student is at critical category.

![Figure 2](chart.png)

**Figure 2.** Percentage of students' critical thinking ability on the learning outdoor by step IEI

**Figure 2** shows that the most of students have the ability to think critically in accordance with the level of cognitive development. Learning outcomes achieved by students illustrate that students are able to understand the basic concepts of ecology based on facts to find themselves. The average of students’ critical thinking ability on each indicator can be seen in Figure 3.
Figure 3. Score of students' ability to provide indicators of critical thinking on the learning outdoor by step IEI (ICT-1: Giving simple explanation, ICT-2: Identify, ICT-3: Translation, ICT-4: Constructing argumentation, and ICT-5: Giving conclusion)

Students identification and translation skills (ICT-2 and ICT-3) show the highest score, indicating students' ability to identify and to classify ecosystem components and to interpret the role of each component of the ecosystem is well understood. Ability is related to the student level ability which is still concrete, factual based on observational data and have not been able to think abstract. The results are supported by several indicators of ICT-1, ICT-4, and ICT-5 which show lower results. All three indicators are students should be able to provide further explanation with the right argument based on the correct concept, about the interaction between components to maintain ecosystem sustainability. The performance analysis showed that the students' ability in concluding had the lowest value because the process of making the conclusion required to make a decision. The low students' achievement from the indicator giving conclusion (ICT-5) with the right argument is inseparable from the development of children's thinking ability. Allegedly, the students' critical thinking skill for each indicator was developed during outdoor learning by step IEI. Step introduction trained critical thinking includes giving simple explanation and identify. Step exploration trained critical thinking include translation and constructing argumentation. The low students' achievement from the indicator giving conclusion (ICT-5) allegedly affected by the implementation. The observation of implementation shows that the guidance given for concluding activity is still not optimal, when the group formulates the problem. Grade VII students of junior high school have an average age of 12-13 years. At this level of age, students are in the ability to observe and collect the facts and information that they get, but they have not been able to relate the variables of each fact with what they obtained. According to the theory of Piaget's cognitive development of children at that age is still thinking at concrete stages. The concrete operation stage can be characterized by a concrete fact-based operating system [7].

Result test analysis between junior high school student of Bengkulu and Kepahyang District obtained significance value $1.154 > p (0.05)$. Thus there is no difference between the two groups. This illustrates that the thinking ability of both group students has relatively equal critical thinking skills. Average score of ability of each indicator also shows the same result (Figure 4).
Critical thinking skills in both schools are related to outdoor learning strategies through IEI steps. Learning is done by involving students to learn actively in constructing knowledge based on observation data. Learning is done not only emphasizes the mastery of concepts, but shapes the mindset and attitude of students to be more concerned about the environment, and able to apply the principles of environmental sustainability. Learning with an environmental approach can help students to apply their knowledge, so it will bridge between the theory and facts that occur in the environment [8]. Science learning is concerned with how to systematically find out about nature, so that it is not only the mastery of the science of facts, concepts, or principles, but also the process of discovery. The acquisition of knowledge from experience makes students more enthusiastic and encourages curiosity or has a scientific attitude [9, 10, 11, 12]. Exploration activities carried out on IE-based environmental science learning with the IEI model illustrates students’ critical thinking skills cannot be separated from student performance through observation, classifying, communicating, measuring, predicting, and differencing [13, 14]. Student performance activities as a manifestation of the ability of scientific attitudes have a contribution in developing students’ high order thinking skills. In the learning, students are directed to understand the environment by introducing environmental conditions, observing the environmental phenomenon, and addressing the exact environmental issues based on the results of its exploration.

Interpretation stage is a unity of exploration stage in both stages students is actively involved physically and mentally in learning. In the interpretation stage, there is a step of presentation and data analysis based on observations that is made at the stage of exploration, through these steps students are invited to think actively, to investigate, to find the answer of the problem, and then to make conclusions. So, through the steps of learning, the ability of analyzing, reasoning, and logical thinking of students will develop according to the level of their development. The steps of learning at both stages are part of the inquiry syntax. [16] and [17] state that discovery-inquiry learning model includes three elements, namely, exploration, invention or concept development, and discovery application. Learning by inquiry can improve intellectual ability and can also encourage students to learn more actively [16].

Outdoor learning strategy with IEI model by utilizing environment creates contextual learning. Contextual learning can always connect or apply the subject matter to the practical realities that it finds in everyday life around the students’ environment. With such contextual learning students will
find the relationship between abstract ideas and practical matters in a real context, and internalize concepts through the process of discovery [17]. The contextual approach assumes that naturally a person's mind will seek meaning that is appropriate to the real-world situation and provide benefits to the environment. Contextual approach is expected to build the knowledge of students that can be applied in everyday life based on learning experience. Contextual learning is a conception of learning that links the subject that has been studied with real situations, so that students will be able to apply their knowledge in everyday life.

Outdoor learning strategy with IEI model that creates student centered learning implementation of student-centred learning on primary education can encourage creativity and motivate students to learn independently [15]. High motivation will encourage curiosity about an object (concept) so that will add understanding to students. The implementation of learning outdoor with model IEI by using the surrounding natural environment has provided a good understanding of environmental concepts. The learning steps undertaken can develop higher-order thinking skills. The learning phase of the IEI model provides students the opportunity to assimilate and accommodate the information obtained, especially about the natural environment. Activity on this learning, students not only read, record and repeat about what they learn, but encourage them in a field activity through observation activities. The observation data is then analyzed based on the understanding of the concept, so that learning becomes more meaningful. According to Bruner's theory and Ausabel's theory of meaningful learning can only occur through learning discovery. Knowledge gained through discovery learning will last a long time, and has the effect of better transfer. Learning invention enhances reasoning and thinking ability freely, exercising cognitive skills, and problem-solving skills.

4. Conclusion

Implementation of outdoor learning conducted through three stages of introduction, exploration and interpretation activities (IEI) can develop the ability of critical thinking on students of SMPN 11 Kota Bengkulu and SMPN Ujang Mas Kepahyang District. The ability to think critically on both schools showed no significant difference. The highest score is at ICT-2 (Identify) and ICT-3 (Translation). The lowest one is at ICT-5 (giving conclusion). The analysis of result data shows that each step of IEI supported critical thinking skill.

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