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THE DEVELOPMENT OF LOCAL WISDOM-BASED NATURAL SCIENCE MODULE TO IMPROVE SCIENCE LITERATION OF STUDENTS

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ABSTRACT

The vulnerability of communities in facing volcano disaster is one of the indicators of the low literacy of science. The low knowledge about volcanic material causes it needs to be packed in an attractive learning so that it can tap into the ability of students' science literacy by using teaching materials that are closer to student learning environments. This research aims to develop the local wisdom-based natural science module on the theme of Mount Kelud eruption, which is both theoretical and empirical. The type of this research development is Research and Development (R & D) by adapting the ASSURE instructional design. The results of this research are the validation results of theoretical feasibility of teaching materials based on the components of material feasibility of 87, 5% with very good category, components of presentation feasibility of 91, 7% with very good category, components of language feasibility of 88, 9% with very good category, components of local wisdom values of 87, 5% with very good category, and components of science literacy feasibility of 88, 9% with 88, 9% with very good category. The results of empirical feasibility are the test results of students' science literacy with N-gain variation value of 0,2; 0,3; and 0,4 respectively with low, medium, and medium category. The results show that the developed local wisdom-based natural science module is suitable to improve the ability of students' science literacy either theoretically or empirically.

Keywords: natural science module; local wisdom; science literacy

INTRODUCTION

The life of people in the globalization era is characterized by the rapidly growing progress of science and technology. It demands the citizen to have basic skills that can be used to socialize in the community. A competitive generation is needed in the natural science and technology referring to the ability of science literacy.

In the 21st century, science literacy becomes the focus of science education or natural science (Safitri et al., 2015), because the development level of a certain nation is determined by the awareness of human resources toward science and technology (Genc, 2015; Jurecki & Wander, 2012; Holbrook & Rannikmäe, 2009; Turgut, 2007). In addition, Programme for International Student Assessment (PISA) defines literary science as the capacity to use scientific knowledge, identify questions, and draw conclusions based on evidence in order to understand and help in making decisions about daily life and interaction between human and nature (Bybee, 2011). Yuenyong and Narjaikaew (2009) define science literacy as knowledge toward science and understanding toward relation between sciences, technology, society, and environment. It shows that the students are hoped to be able to master the scientific knowledge and apply it in the daily life. Science for All American defines litera-

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ry science as an ability to understand concept, science principle, and scientific thinking to solve problems relating to science. An understanding of learning directing to the shaping of science literacy on students is apparently still lacking in Indonesia. It can be seen from the vulnerability of Indonesian citizens toward the threat of a volcano. According to (Safitri et al., 2015) that the ability of students' science literacy of Indonesia is still low. It is proven from the research results conducted by PISA (Programme for International Student Assessment) organized by PISA in 2012. The results stated that the ability of students' science literacy of Indonesia with the subject of fifteen-years-old students ranked 64th out of 65 participating countries that are below the PISA average standard is 500. The score result of science is only 382. In every three years, the ranking of Indonesia continues to decline. The decrease in science literacy skills is further strengthened by the low level of learners' knowledge of volcano-related problems.

This is also strengthened by Martin's research in Hariyono (2014), which shows that the average score of Indonesian students' ability in Earth Science material is 33, much lower than the international average of 45. The ability of science literacy for learners is important to master, considering that Indonesia is an archipelagic country located at the meeting of three major tectonic plates of the world, the Euro-Asia Plate in the North, the Indo-Australian Plate in the South and the Philippine-Pacific Ocean Plate in the East. This makes Indonesia be a country with high levels of vulnerability to natural disasters, one of which is volcanic eruptions.

Indonesia is a country that is located in the Ring of Fire because it is surrounded by a meeting of tectonic plates with an active volcano row. Indonesia has 127 active volcanoes comprising of 76 type A volcano, 30 type B volcanoes, and 21 type C volcanoes. Type A volcanoes are spread in several locations such as in East Java as many as 19 volcanoes, one of which is Mount Kelud, which is located between Kediri, Blitar, and Malang (Anwari, 2015). The eruption of Mount Kelud in 2014 caused the Ngantang District to be the most severely affected. This is because the Ngantang District is the closest area to Kelud Crater, which is about 7-10 km. The volcanic ash, which reaches the Ngantang District, has a thickness of 20-30 cm with a diameter of 5-8 cm (Syiko in Ma'arif et al., 2012). Until now, Mount Kelud is declared as an active volcano that is still possible to happen an eruption in the future. Knowledge of natural disasters needs to be held in disaster prone areas, especially volcanoes.

SMP Negeri 1 Puncu is a school, which is located on the slopes of Mount Kelud, Kediri Regency. As a school vulnerable to a volcanic eruption, knowledge of volcano problems should be fully understood by students. The results of the dissemination of test sheets given to 28 Grade VIII-G students of SMP Negeri 1 Puncu indicate that all students have experienced an eruption of Mount Kelud, 38% of students know the cause of eruption, and 44% of students can explain the signs of the eruption of Mount correctly. From the students 'answers, several problems were found, such as students assuming that the volcano erupted due to natural conditions and the mountains were old, the students still had difficulties in distinguishing lava and magma, and most of the students' answers were not accompanied by scientific explanations. Djulia in Sudarmin (2014) explained that the low literacy of science and the quality of education in Indonesia had been predicted because of the lack of attention to the socio-cultural environment as a source of learning.

The villagers on the slopes of Mount Kelud for generations have recognized the volcano activity. The area around Mount Kelud has local wisdom that appears and develops from generation to generation in the form of knowledge, customs, and ethics that guide the community in facing eruption disaster. One of the local wisdom that developed in the society is signs of the eruption of Mount Kelud. People believe that if there are a red-tailed ape and Turtledove birds "Gung" which go down to the residential areas, the eruption of Mount Kelud will happen. Ma'arif et al. (2012) concluded that each community group has knowledge and ways to deal with the environment for their survival. It is known as "wisdom to cope with the local events" or often abbreviated as "local wisdom." Based on the result of teacher interview, there is no teaching material describing the local wisdom of the local area.

Regulation of the Minister of National Education number 22 of 2006 which states that each educational unit can offer to learn in accordance with the interests and talents of learners as well as local potential, cultural environment, economic conditions and regional needs, with competence standards and basic competencies self-developed. Education Unit Level Curriculum provides schools and teachers the freedom to develop their own curriculum according to the needs and circumstances of the community around the school (Isnaini, 2013). Cultural-oriented learning (ethnosains) is based on the recognition of cultu-

re as a fundamental part of education to express and communicate an idea and the development of knowledge (Ryan, 2010). Atmojo (2012) has tried to meet the challenge, by making a science-based teaching design using ethnoscience approach through the cultural context of making soybean cake *(tempe)*. Based on this, teachers are expected to develop lessons that can utilize local wisdom as a learning resource. Modules can be used as teaching materials that can connect knowledge of science with the local wisdom.

Sardjiyo (2005) states that the development of IPA learning media based on ethnosciences approach is a way to create a learning atmosphere and learning experience that integrates local wisdom in the process of science learning. This is in line with Khoiri (2016), he stated that learning that connects the context of local potential with learning materials would help the learner to achieve the learning objectives. Knowledge of local potential is closely linked to the learner's experience. Osborn (2003) explains that the learner experience or prior-knowledge will have a positive impact on the learning attitudes of science. In addition, learners who have had learning experiences related to local wisdom will tend to gain cognitive improvement because they are more motivated (Tosun and Taskesenligil, 2011). Sajidan et al. (2015) have also successfully implemented this kind of learning. The study showed that 85% of learners were able to connect to the concept of IPA and local knowledge in the community. Therefore, the researcher suggests that prospective IPA teachers should emphasize on the exploration skills of learning source, which derived from the socio-cultural environment to increase understanding of the IPA concepts.

Based on the open questionnaire, which is distributed to students of grade VIII-G SMP Negeri 1 Puncu, it is found that 43% of students want modules that contained information of everyday life. Learning resources using cultural and local wisdom approaches are expected to make learners to achieve established competencies. In addition, learners also obtain the more meaningful learning because it is close to the cultural environment.

The Aprilia's Research (2015) states that the booklet of ethnosciences (Indegenous Science and Local Wisdom) is worth theoretically to be used in the learning process on the diversity of matter, and the ability of science literacy, as well as Sudarmin & Samini (2015), states that the use of integrated module of ethnosciences in learning Problem-based is effective used for student literacy skills.

From the description above, then, it is conducted research and development of local-based wisdom IPA module by using the theme of Kelud Mount eruption to teach the science literacy towards students SMP Negeri 1 Puncu.

METHODS

This research is using research and development (R & D) method by adapting the instructional design ASSURE. The development of IPA modules local wisdom -based is reviewed based on theoretical and empirical feasibility. The target of this research is IPA module based local wisdom. The development stage was conducted in major of S-1 IPA Education in Mathematics and Sciences Faculty (FMIPA) and limited trial at SMP Negeri 1 Puncu with 15 students of class VIII. The limited trial design is using One Group Pretest-Posttest Design. The data obtained in this research is the result of validation of local wisdom-based IPA module and the result of student's science literacy test.

The result of local wisdom IPA module validation was analyzed by quantitative descriptive. The analysis method used in the study as follows:

$$P = \frac{f}{N} \times 100\%$$

By the description of 'p' is the percentage of eligibility module, N is the maximum number of scores and f is the number of scores obtained. The local wisdom-based IPA module is considered to be deserved as a good category if the validation rating achieves ≥69% (Akbar, 2013).

A science literacy test of the student is used to measure students' literacy skills. To calculate the science literacy test scores of students using the formula as follow:

$$\text{Score} = \frac{\text{Total score of answers}}{\text{Maximum score}} \times 100\%$$

Then, the scores obtained are interpreted into science literacy level scores according to PISA (Yuliantika in Inzanah, 2014). The increasing of student science literacy was analyzed by normalized N-gain formula:

$$\text{N-gain} = \frac{\text{posttest score - pretest score}}{\text{maximum score - pretest score}}$$

With criteria of the gain score, $g \geq 0.7$ is a high category, $0.3 \leq g < 0.7$ is a medium category and $g < 0.3$ is a low category.

RESULTS AND DISCUSSION

The research entitled "The feasibility of Local Wisdom-based IPA Module to Improve Literacy of Student Science" has been implemented

and collected various data needed. Then, the data are analyzed to determine the feasibility of the modules applied in the learning as it is reviewed from the theoretical and empirical feasibility. The theoretical feasibility can be determined from the validation done by ethno sciences expert, lecturer as the expert of material, and science teacher. Empirical feasibility can be seen from the results of students' science literacy tests. The result of the feasibility of the module theoretically explained in Table 1 below.

Table 1. The theoretical feasibility of module

Component	Score (%)	Category
Material	87,5	Very good
Language	91,7	Very good
Presentation	88,9	Very good
Local wisdom	87,5	Very good
Science literacy	88,9	Very good

The development of local wisdom-based IPA module consists of five components. They are material feasibility, presentation, language, conformity with local wisdom values and their compatibility with science literacy. Based on Table 1, the local wisdom-based IPA module, the overall material feasibility component results in an average percentage of 87.5% with very good feasibility categories. The overall feasibility of the presentation results in an average percentage of 91.7% with very good feasibility categories. The overall language feasibility gets 88.9% percentage with very good feasibility category. The feasibility of conformity with local wisdom values as a whole gets an average percentage of 87.5% very good feasibility categories. The feasibility of conformity with the overall science literacy dimension gets an average percentage of 88.9% with very good feasibility categories.

The eligibility of the module theoretically gets an average of percentage score 88.9 with the good category. According to Rusilowati et al. (2016), she states that local wisdom-based IPA modules are considered to be appropriate as in good category if the validation assessment reaches 77%. Therefore, it can be said that the local wisdom-based IPA module developed is appropriate theoretically used in learning.

Scientific literacy capabilities measured includes the dimensions of content, context, and process. The test given is in the form of multiple choice questions amounted to 10 questions that oriented science literacy. The table 2 below is Pretest and Posttest results.

Table 2. Pretest and Posttest results

Science Literacy Level	Achievement Percentage		N-Gain	Criteria
	Pretest	Postest		
2	80,0	6,7	-3,7	(Decreased)
3	13,3	26,7	0,2	Low
4	6,7	39,9	0,4	Medium
5	0	26,7	0,3	Medium

Based on Table 2, pretest results show 13.3% of students are in level 3 of science literacy ability, 6.7% of students are in level 4 of science literacy ability, and the remaining 80.0% are in level 2 of science literacy ability. After the implementation of learning by using local wisdom-based IPA module, the posttest result shows that the remaining 6,7% of students are in level 2 of science literacy ability. This result indicates that most students experience a change in literacy skills of science that initially in level 2 becomes to a higher level. Table 2 also shows 26.7% with science literacy ability of level 3, 39.9% of students with science literacy ability of level 4 and the remaining 26.7% of students are in science literacy ability of level 5. Improvement of science literacy can be made through improvement of the learning process (Sujana, et al., 2014).

Based on the results of the pretest from 15 students in Table 2, the large percentage is in the science literacy ability of level 2 (Fleischman et al., 2010) stated that at that level students have sufficient science knowledge to provide explanations or draw conclusions based on simple inquiry. Students are able to provide direct reasoning and make general interpretations of the results of scientific inquiry or problem solving from technological aspects. Posttest results show the largest percentage is at level 4. At these levels indicates that students can work effectively with situations and problems that may involve explicit phenomena. Therefore, it requires them to make inferences about the role of science and technology knowledge (Fleischman et al., 2010).

The results are quite satisfactory by seeing from the low of science literacy level achieved in Indonesia. PISA (2012) states that 22% of Indonesian students are at level 2 and only 2% are able to reach level 3 and above. The science literacy level of Indonesian students is in the second rank from the lowest level of PISA after Peru. The level achievement of students' science literacy ability between the PISA results and the limited trial results is different. This is due to the difference in standard questions given by PISA. In additi-

on, there are other factors such as the potential, regional characteristics, social and cultural communities and the diversity of Indonesia students. Those factors will certainly give effect to the aspects of learning and the ability of science literacy students. Inzanah (2013) states the results of science literacy can be different from PISA results if it is conducted in a smaller scope.

The ability of science literacy can be improved by taking into account the characteristics and potential of students, and the development of teaching materials, which is accordance with student learning environment. As Yusuf (2011) states that teaching materials can be obtained from supported sources of life-skills, authentic materials, and having a cultural value that is appropriate to the learning experience. This research is focusing on the development of teaching materials in the form of IPA module based local wisdom community of Mount Kelud. This is in line with Djulia's statement (Sudarmin, 2014), the low level of science literacy and the quality of education in Indonesia has been predicted because of the lack of attention to the socio-cultural environment as a source of learning. Therefore, it is required teaching materials in accordance with the socio-cultural environment of students. Parmin (2015) states that the development of culture in the community should be used as material in the development of teaching materials of IPA.

The development of student science literacy is seen from pretest and posttest score by using N-gain analysis. The result of N-gain analysis can be presented in Table 2, which is informing that the increase of science literacy result is in the low and medium category. The development of science literacy is not maximal because the teacher does not give more time in science literacy training. It means that it needs to add more time allocation in the science lesson to improve students' science literacy. Therefore, it can be used in future research. However, in the medium category, it can be seen that there is an increase in student science literacy. The local-based science wisdom of IPA learning can encourage students to construct and make connections between the knowledge and reality in the environment.

Local wisdom-based IPA modules can be developed by reconstructing origin science into western science or scientific science (Khusniati, 2014). An experiment activity is conducted based on the LKS that contained in local wisdom based module. The module of Mount Kelud Eruption is not only focusing on material content about Volcano Eruption, but also there is context dimension in the form of the local wisdom of people around Kelud mount. The Student Worksheet (LKS) contained in the module is linked to the local wisdom values of the local community including public belief about the causes of erupting volcanoes, then, it is examined by performing simple experimental activities.

Through simple experiments, students can explain the scientific phenomenon, which is one of the indicators of process dimensions. In the module, there is also an LKS where students are assigned to explain the scientific science that is found in the local wisdom of the native people by using local wisdom IPA module. Therefore, students can answer the questions of pretest and posttest that required explaining the scientific science contained in local wisdom around student learning environment. This is similar to the statement of Holbrook (2005) that science will be easy to learn when it makes sense in the students' view and it relates to the human environment, interests, and aspirations. According to Sudarmin & Samini (2015), learning using an integrated module of ethno sciences in problem-based learning also provides an opportunity for students to involve directly and actively in scientific activities, and provide worth experience to students about IPA learning in the context of local wisdom. Therefore, the concepts received by students will be easy to remember. The students become more familiar with the material being studied. This is similar to the statement that expressed by Susilowati et al. (2014) maximum activity is generally followed by good learning results.

CONCLUSION

Based on the results of the research above, it can conclude that local-based wisdom IPA module by using the theme of Mount Kelud eruption developed is feasible, theoretically and empirically. It is based on the suitability of the material feasibility component is 87.5% of the very good category. The feasibility of presentation is 91.7% of the very good category. The language feasibility component is 88.9% of the very good category. The local wisdom values component is 87.5% of the very good category. In addition, the science literacy feasibility component is 88.9% of the very good category. Based on result Student science literacy test with a value of the variation of N-gain 0,2; 0.3; And 0.4 respectively with low, medium, and moderate categories. The suggestions to this research are a module that has been developed is appropriate to used by science teacher of SMP as material to teach topics related to natural phenomena and ecosystem. It has a purpose of imp-

roving the skill of literacy of junior high school student.

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