The Effectiveness of Performance Assessment in Project-Based Learning by Utilizing Local Potential to Increase the Science Literacy

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ABSTRACT

Learning science requires students not only to remember the subject matter but also to develop science literacy. One of the ways to develop science literacy competencies is by applying performance assessment in project-based learning that utilizes local potential. This study aims to determine the effectiveness of performance assessment in local-potential-based learning on environmental pollution subject matter. The research was carried out using a quasi-experimental method with a pre- and post-test design. The sample for the research is 7th grade students in Pontianak, and the data collection tool is an observation sheet using a science literacy rubric test. The research results show that performance assessment of project-based learning utilizing local potential can increase students' science literacy.

Keywords: performance assessment; project-based learning; science literacy

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INTRODUCTION

The Indonesian government's desire, as put forward in constitution number 20, section 36, 2013, is for the development of a curriculum that makes use of the diversity of local potentials, providing opportunities for educators to develop local-potential-based learning. However, this opportunity has not been well-used by teachers because they are constrained by a lack of understanding of how to develop such potential in learning. Many local potentials are not yet integrated into learning (Diwanto, Wilujeng, Prasetyo, & Suryadarma, 2017), even though such implementation in learning will increase the awareness of students about its advantages as well as enabling them to recognize the value of local wisdom.

Science (natural sciences) is one of the subjects that can be taught using local potential integration. Science learning requires that students not only have knowledge of science but can also apply such knowledge to solve problems in daily life, thus developing science literacy. Science learning should be able to reference scientific problems encountered in daily life and facilitate students to be active in their learning about them. The reality of the learning process in schools tends not to be associated with real-life situations that occur in students' social environments (Hairida, 2017). Science learning has not yet developed the science literacy of students, but rather tends to emphasize cognitive aspects (Hastuti, Nurohman, & Wibowo, 2013).

Ability in science literacy must be "owned" by students, and thus it needs to be developed by teachers in learning. Science literacy can be defined as the ability of a person to identify the facts of science using appropriate methods of inquiry to obtain the necessary scientific evidence, and then having the ability to analyze and interpret such evidence in order to obtain meaningful conclusions (Gormally, Brickman, & Lutz, 2012). The low science literacy skills of students in Indonesia may be influenced by several factors, such as the instructional model applied by teachers and the teaching materials used by students (Kurnia, Zulherman, & Fathurohman, 2014).

A form of learning that can train students to carry out an investigation in order to solve problems encountered in real life is project-based learning. This is learning that organizes students to build their knowledge independently through in-depth investigation to solve problems in a planned way (Tseng, Chang, Lou, & Chen, 2013). In such learning, students carry out various activities and inquiries and make decisions based on their own knowledge and on the acquisition of knowledge and skills from various activities within the project (Uziak, 2016).

Expert opinions on project-based learning suggest that it strongly supports the development of science literacy. Teachers of science can use this type of learning to investigate the problems that occur in daily life by providing hands-on experience through using the local potential available around students. However, the results of observations in a junior high school in Pontianak show that project-based learning is rarely used by educators to teach science. The results of this study indicate that science learning in the studied school has not been taught in accordance with the authentic meaning of science, making it difficult for students to relate the concepts learned in school to various real-life problems. This also

happens in other countries where teachers rarely use project-based learning. As many as 91.6% of teachers in Zimbabwe still use conventional learning to teach theory only, with the remainder using project approaches (Ruparanganda, Rwodzi, & Mukundu, 2013).

Efforts to solve the problem of students not respecting the problems and their local potential can be carried out using project-based learning combined with local potential. Project-based learning is a learning model that begins from complex problems that occur in society, and into which students then conduct investigations by collecting and integrating their knowledge and performing activities in the real world (Mulhayatiah, 2014). Teachers can assess students in real terms according to their competence (Kasmadi, Harsiati, & Nurhadi, 2016). All activities of students in these projects can be judged by so-called "authentic" assessment. Authentic assessment is a technique that can used by teachers to assess the professional and personal development of students, in contrast to traditional ways of assessing student's knowledge, skills, and attitudes (Mhlauli & Kgosidialwa, 2016). However, teachers are less interested in using authentic assessment due to their limited ability in such assessment and the time required to conduct it (Alfian, Aminah, & Sarwanto, 2015). As a result, assessment of skills and attitudes has not been optimally implemented by teachers and is limited to paper-and-pencil (Hairida, 2016).

Performance assessment is one type of authentic assessment. Performance assessment is an assessment of the acquisition and application of knowledge and skills as well as the results produced that prove students' ability in the learning process (Sa'idah, Yulistianti, & Farida, 2017). Because of the many activities undertaken by students during project-based learning, performance assessment is an appropriate tool for teachers to use. Project-based learning requires an assessment technique that can be continuously and regularly used to measure and evaluate the development and activities of students and is therefore one of the most appropriate assessment techniques used to evaluate both the processes undertaken and the project outcomes. Performance assessment in project-based learning emphasizes the ability of students to carry out discussions, design projects to solve real problems, prepare and give presentations, and create reports or papers. Thus, performance assessment in project-based learning can increase students' science literacy.

Environmental pollution is one of the science topics taught in junior high school. Learning material is closely related to the environment around students and so is very appropriate for project-based learning utilizing local potential. Environmental pollution material provides many real problems that can be raised by educators in learning and which is therefore interesting to investigate [15] (Titin, Sunamo, & Masyukuri, 2012). Activities undertaken by students vary greatly in project-based learning, so the performance of students is also varied. However, teachers' skills in designing performance assessment are still poor. This leads to the overall performance of students in such learning being not clearly defined. In addition, science literacy also lacks attention from educators. Students are not invited to understand the phenomena that occur in the environment based on the concepts they have learned in school. As a result, research into performance assessment in project-based learning which utilizes local potential to

improve the ability of students' science literacy is urgently required. Through this research, the science literacy and knowledge of students about local potentials can be increase. This project-based learning tool is also useful for educators in designing the integration of local potential into learning for other topics.

METHOD

According to the purpose of this research, which is to determine the effectiveness of performance assessment in project-based learning by utilizing local potentials to increase the science literacy of junior high school students, the methodology applied is pre-experimental in design (one-group pre-test/post-test design). This type of research was used because only one class was investigated, namely class VII SMPN 23 Pontianak, and so a purposive sampling technique was applied. A control class was not used in this study. Before treatment, the sample was given a pre-test, and this was followed by a post-test after delivery of the treatment. A description test relating to science literacy competencies was used in the pre-test phase, while the post-test used an observation sheet with an assessment rubric of science literacy competencies. Interview guides and a performance observation sheet were used to complete the data analysis. Before use, the rubric assessment was validated for science literacy data. The content validation was performed by one lecturer and one junior high school science teacher with the content aspect of the assessment criteria indicating that the rubric assessment was appropriate for evaluating the students' science literacy. The competence of science literacy was assessed through the results of reports of activities that had been carried out by students to 1) explain scientific phenomena, 2) make project designs that would be implemented, and 3) evaluate scientific research and interpret data from field investigations and scientific evidence.

Data analysis in this study used descriptive techniques and inferential data analysis. The purpose of the descriptive analysis is to provide a general description of competence in science literacy and the performance of students at each stage of project-based learning. The inferential data analysis is used to test the research hypothesis. Data processing used SPSS. Before undertaking hypothesis testing, prerequisite tests—the Kolmogorov-Smirnov normality test and Levene's homogeneity test—were performed. Hypothesis testing used a T test.

RESULTS

The descriptive data for science literacy competencies were obtained by analysis of the results of observations of students' work reported using an assessment rubric of science literacy competencies after the treatment. Data before treatment were obtained through a descriptive test related to science literacy competencies. The assessment rubric of science literacy competencies consisted of three sections: 1) competencies to describe scientific phenomena with indicators for formulating projects; 2) competencies to evaluate and design scientific activities with indicators for planning project activities; and 3) competencies to interpret

data and scientific evidence with indicators for data collecting, data interpreting, drawing conclusions and giving advice to the community.

The results presented in Figure 1 show that after applying performance assessment to project-based learning utilizing local potential, the competence score for science literacy related to describe scientific phenomenon is greater than the score of both competencies.

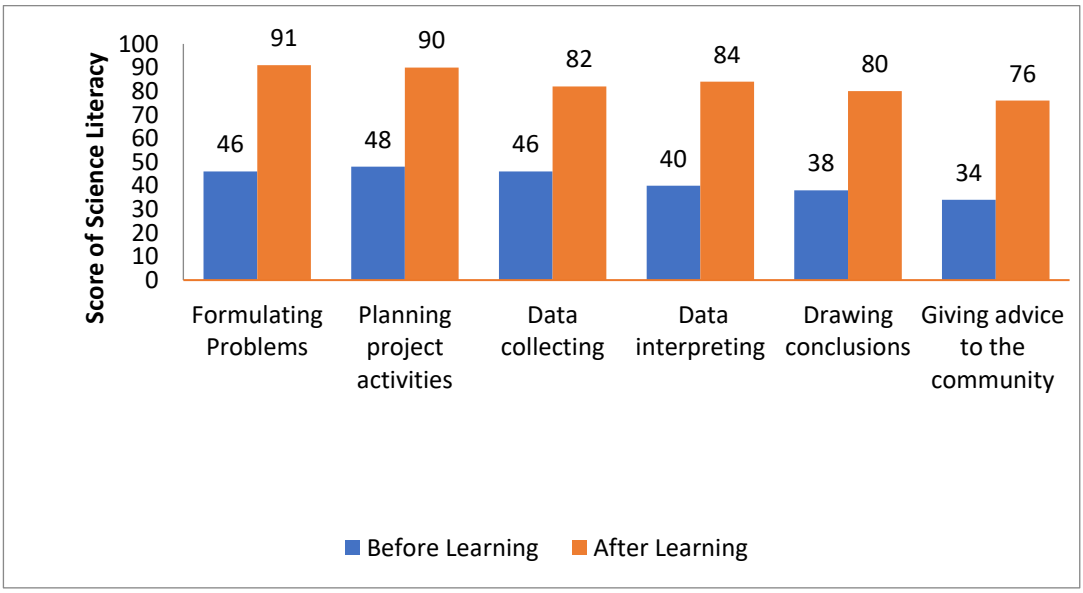

Fig. 1: Science Literacy Competencies of Students Before and After Learning

Furthermore, the analysis of student performance data at each stage of the project-based learning found that the highest performance score was for the third stage, that is the preparation of the schedule, while the lowest performance score was for the first stage, that is the determination of fundamental questions (Figure 2). At the preparation of schedule stage, students are directed to be creative in determining how their projects are created and implemented. Students arrange a schedule to keep the project on track and to ensure effective completion.

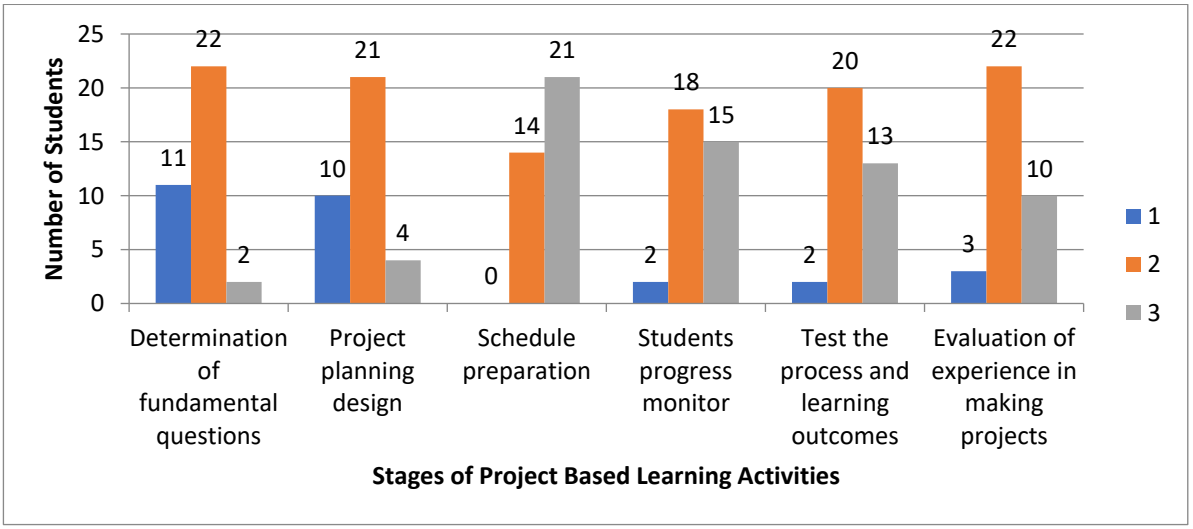

Fig. 2: Scores for Students' Performance at Each Stage of Project-based Learning

Inferential data analysis was conducted to test the research hypothesis. To determine the appropriate statistical test, the requirements were first tested. The Kolmogorov-Smirnov normality test obtained a significance value of 0.23, which was greater than the significance level of 0.05, so it was concluded that data distribution was normal. Furthermore, homogeneity was tested using Levene's test and a value of significance of 0.214, i.e. > 0.05, was obtained, meaning that the data for science literacy capabilities before and after the performance assessment was applied in project-based learning by utilizing local potentials has the same variance. Hypothesis testing obtained a value of 7.49 for average science literacy ability of science students before application of performance assessment in project learning by utilizing local potency, whereas after applying performance assessment this value was 15.14. Next, the value of *t* arithmetic was -17.895 with significance of 0.00. Because significance is < 0.05 it is concluded that H_0 is rejected, meaning the average of students' science literacy before and after applied performance assessment in project-based learning utilizing local potential is different. Thus, it is concluded that the implementation of performance assessment in project learning utilizing local potential is effective in increasing students' science literacy. This suggests that the improvement in students' science literacy is influenced by the application of performance assessment in project-based learning utilizing local potential.

DISCUSSION

Based on the results of the data analysis, it is concluded that the implementation of performance assessment in project-based learning by utilizing local potential is effective in improving students' science literacy. The results of this study are supported by Adawiah, Side, and Alimin (2014), who suggest that there was an influence of performance assessment in the project-based learning model on the learning outcomes of MS students of SMA Negeri 3 Lau Maros for the subject of chemical equilibrium. In line with the results of McCright's (2012) study, we conclude that students' science literacy skills are increased through the application of inquiry-project-based learning.

The increase in students' science literacy in project-based learning reflects students' preferences for performance involvement in a variety of learning activities. Project-based learning encourages students to engage in various inquiry, discovery, and decision-making activities on knowledge-based issues, so as to influence their learning motivation, critical thinking, and cognitive skills (Insyasiska, Zubaidah, & Susilo, 2015) and support the development of interest in the environment (Ibrohim, 2015; Mardikaningtyas, 2016). All these aspects support the improvement of students' science literacy.

The effect of applying performance assessment in project-based learning by utilizing local potential to develop students' science literacy can be seen from the results of the questionnaire responses about the learning implemented. The results show that 71.43% of students agree with the implementation of project-based learning by utilizing local potential because they are actively involved in various learning activities. In contrast, the questionnaire responses about their traditional science lessons suggest that these lessons tend to provide fewer opportunities for

students to develop their potential, with 88.57% of students agreeing with this view. This suggests that lesson-based science learning tends to be teacher centered and that the individual characteristics of students in learning are not considered by teachers. In line with Hairida and Hadi's (2017) preliminary study in a high school in Pontianak, results show that learning is still dominated by teachers and is not associated with real life.

Research findings from the results of data analysis of competence in science literacy show that the more complex the competence, the lower the competence score of students. The competence relating to being able to explain scientific phenomenon obtained the highest score compared with other science literacy competences. This is supported by the results of Tjalla's (2008) study which suggest that the ability to explain scientific phenomena is the most developed competence of science literacy in Indonesia while the poorest is the ability to use scientific facts. In line with the results of Sari, Rusilowati, and Nuswowati (2017), the highest level of scientific literacy lies in the ability to explain scientific phenomena while the lowest is in the ability to interpret data and scientific evidence.

The observations at each stage of the project-based learning activity show that in the first and second stages (project determination and project scaling design completion), student performance in learning is still low. Only six students (17%) had a score of 3 in both of these stages; generally scores were either 1 or 2. This activity did not stimulate the students' performance to independently develop the project or to search for facts relevant to the project to be implemented. This was likely to be because the students were not yet familiar with learning that requires them to be active in their learning. However, in the third stage, the schedule of project implementation, the performance of students in learning began to improve in comparison with the previous stage. Students actively and enthusiastically arranged a schedule of activities to enable completion of the project and to developed explanations or reasons for their selection of these activities. The teacher notified students that performance assessment would be conducted at this stage so that students wanted to work optimally on the project. At this stage, students were devising the project deadline, planning new project activities creatively, and exploring the reasons for their selections of projects and processes. Through project-based learning, students will learn authentically because they are motivated by the desire to answer questions they have been asked; thus, learning becomes more effective and meaningful (Muderawan, Sastricka, & Sadia). At this stage of the learning activity, 60% of students obtained a score of 3, while the rest had a score of 2.

The fourth stage of project-based learning is the completion of projects with teacher guidance and monitoring. Students are trained and guided to develop their knowledge, characteristics, and skills in completing the project. At this stage, the teacher monitored the activity by assessing the performance of students in completing the project. The results of the performance assessment in this activity indicate that the students' performance score was better than in the first and second stages, but below the third stage. Students become motivated to achieve the best results in project work because when undertaking project-based learning they are given the opportunity to use their knowledge creatively to produce the

product required (Robinson, 2013). The fifth stage is the preparation of reports and presentations. The results of interviews with students concluded that students feel confident in making reports and presentations through project-based learning because the learning is guided by the teacher. Performance assessment scores at this stage show the students' performance is better than in the first and second stages but does not exceed the score in the third stage. This is in line with the results of Darmuki (2013), who concludes that the ability of students in preparing reports showed significant improvement after project-based learning.

The last stage of this project-based learning is evaluation of the process used and the project outcomes. Teacher and students reflected on the results of project tasks and activities that had been implemented. Existing weaknesses were improved by taking new actions closer to solving the problem. Students' performance in learning also increased compared to the first and second stages, but the score was not higher than the third and fifth stages. This may be because the learning experience owned by students at this stage is more complex than in the fourth and fifth stages. Discussions between teachers and students should be further developed until new skills and activities are created which improve on the current ones. Teachers and students need to review the literature or browse the internet to develop their knowledge and experience, but are not yet accustomed to this type of activity.

Overall, the stages of the project-based learning process support the development of science literacy. Student involvement in learning improves as the learning process progresses. This means that students enjoy project-based learning through utilizing local potential. Project tasks assigned to students fall into the category of practice by doing/practice in real life and provide retention rates of around 75%, because project work encourages students to conduct investigations and create presentations (Susilowati, Iswari, & Sukaesih, 2013). These activities are enjoyed by students as types of learning that prioritize liveliness and direct student involvement with experiences generally liked by students (Hayati, Supardi, & Miswasi, 2013). Thus, the application of performance assessment in project-based learning by utilizing local potential is effective for increasing students' science literacy.

CONCLUSION

Based on the results of this research and data analysis it is concluded that the implementation of performance assessment in project-based learning by utilizing local potential is effective in increasing students' science literacy. The highest competence score of students is for their ability to explain scientific phenomenon. Viewed from the point of view of the stages of project-based learning activities, the highest score for student performance is in the stage of preparation of the project schedule while the lowest performance score is for the stage of determining fundamental questions.

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