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Research Article

Information literacy skill: An alternative to support biology student's learning outcomes

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ABSTRACT

Information literacy is a fundamental aspect to ease students in encompassing the knowledge-making process as well as empowering their capacity in using and creating various information and knowledge products. The purpose of this study was to determine the effect of integrating information literacy rubric with Project-Based Learning on students' learning outcomes in Structure of Plant Development course. This quasi-experimental research used a non-randomized pretest-posttest control group design. The population in this study was the all biology department undergraduate students at the Universitas Negeri Malang in 2018/2019 academic year. The sample consisted of 120 students which were divided into two groups (control and experiment). The data gained was analyzed using one-way ANCOVA. The results showed that Project-Based Learning which was integrated with information literacy rubric had a significant impact on biology students' learning outcomes. Based on the findings, it is suggested that educators should provide a proper strategy as an effort to support their students' learning outcomes.

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INTRODUCTION

The fast and rapid development of information and technology in the 21st-Century becomes a challenge for educators. The challenges are to educate students as curious individuals, to think critically, and communicate effectively (Bell, 2010; Binkley et al., 2014; Erich & Popescu, 2010; Greenstein, 2012). Saglam, Cankaya, Ucer, and Cetin (2017) argues that the development of information technology has a significant impact on education, the most important problem to overcome in the 21st-Century is instilling information literacy to students. The purpose of information literacy is fundamentally helping students to understand the knowledge-making process and strengthen their capacity in terms of using and creating a variety of information or knowledge products (Feng & Ha, 2016; Fullard, 2017; Ranaweera, 2017). The definition of information literacy is a set of integrated

capabilities that include: 1) identification of the extent of information needed; 2) accessing information effectively and efficiently; 3) critically evaluate information and sources; 4) use information effectively to achieve individual goals; 5) access and use information ethically and legally (Hulett et al., 2013; Klucevsek & Brungard, 2016). Information literacy is generally needed to find, take, analyze, and use information (Ranaweera, 2017).

Information literacy is an important skill to be empowered. With information literacy, students will become learning human beings (Feng & Ha, 2016). Ranaweera (2017) adds through information literacy, students are provided with an ability to recognize when they need information, where to locate it, how to use it effectively and efficiently, also evaluate the information and sources critically. In spite of the importance of information literacy, it is reported that information literacy skills of Indonesian high school and higher education students belong to a low category. PISA (2015) reported that Indonesia student's reading proficiency score is 397 which belongs to the 1b level. It means that Indonesian students can make a simple connection between information in the text and common everyday knowledge, but still incapable to make a reflection and critically evaluate the quality of a worth-to-read text. The low reading proficiency contributes to the low level of information literacy skill in higher education. Sinurat, Zulharman, and Amtarina (2017) showed that college students are commonly able to decide the extent of needed information, access information effectively but still unable to evaluate the information resources efficiently and critically. A low-skilled person will affect the learning outcome of that person since learning itself needs skill in managing information. These phenomena are caused by the implementation of inappropriate learning strategies.

Information literacy skills in traditional learning are often not honed because students are only passive recipients of information through the lecture method (Detlor et al. 2012). Some of the lecturer's teaching is more likely to provide extensive scientific content without regarding the process of how students achieve learning goals (Stefani, 2009). Whereas biology students need to be trained to be skilled in information literacy in developing scientific methods. McFarlane (2013) states that learning science is advancing factual, principle and procedural knowledge through scientific means. Flierl, Bonem, Maybee, and Fundator (2018) emphasize information literacy as an essential result of undergraduate education. Porter et al. (2010) add that it is necessary to provide authentic learning opportunities for first-year biology students by exploring science as a process, so students may turn into information literates. Information literacy can be developed using appropriate learning models/strategies/methods (Dolničar, Podgornik, & Bartol, 2017; Dunne, Dunne, & Sheridan, 2012; Genlott & Grönlund, 2013; Hulett et al., 2013; Karimi, Ashrafi-Rizi, Papi, Shahrzadi, & Hassanzadeh, 2015). One learning model that can improve skills information literacy is Project-Based Learning (PjBL) (Chu, Tse, & Chow, 2011; Eliana, Senam, Wilujeng, & Jumadi, 2016; Saliba, Mussleman, Fernandes, & Bendriss, 2017).

PjBL is considered a better effort than a lecture method since involving an in-depth exploration of issues, themes or problems without predefined answers (Harada, Kirio, & Yamamoto, 2008). The previous study by Saptasari, Sunarmi, and Sulasmi (2018) found that there was no effect of PjBL on biology student's botanical literacy skills, another form of information literacy skill which is emphasizing on botany, in the Structure and Development of Plants course. The study showed that students experience several obstacles in completing the project, such as 1) having difficulty in reading and taking the core of scientific reading material content; 2) inadequate research sources in compiling articles and analyzing data; 3) students often use reference sources that cannot be justified. In line with Wijaya, Sudjimat, and Nyoto (2016) stated that there were commonly found errors during the information literacy learning process such as misunderstanding the instruction and error in selecting information. Therefore PjBL itself should be combined by a learning tool which provides direct feedback to maximize its effect upon the information literacy skill.

A learning tool which provides direct feedback toward the student's process is a formative assessment. Davies, Earle, McMahon, Howe, and Collier (2017) stated that a formative assessment is a process used by teachers and students during instruction that provides feedback to adjust ongoing teaching and learning to improve student's achievement of an intended instructional outcome. Through formative assessments, teachers monitor student progress, provide students feedback and adjust instructional approaches toward improved teaching and learning (Andersson & Palm, 2017; Hansen & Ringdal, 2018; Hooker, 2017). In other words, a formative assessment may also help students identify their strengths and weakness and the target areas that need to be worked on (Hansen & Ringdal, 2018; Xiao & Yang, 2019; Zainuddin, Shujahat, Haruna, & Chu, 2020). Additionally, it helps the teacher recognize where students are struggling and address problems immediately. There are still barely found any research trying to determine the effect of integrating formative assessment in a certain learning model in order to promote student's learning outcomes through information literacy. Thus, this research aims to determine the effect of integrating information literacy rubric, as a formative assessment, on Project-Based Learning in student's learning outcomes during the Structure of Plant Development course.

METHOD

This quasi-experimental research was using a nonrandomized pretest-posttest control group design (Leedy & Ormrod, 2019) as shown in Table 1. The study conducted in March - November 2018. The population in the study was all Biology Department undergraduate students at the Universitas Negeri Malang in the 2018/2019 academic year. The sample used was consisted of 120 students who took the Structure of Plant Development course. The sample divided into two study groups (control and experimental group). Each study group consisted of two classes. Control groups used a project-based learning model while the experimental groups used a project-based learning model that integrated the information literacy rubric. Both groups are equally given the same project which is making a scientific paper as an alternative problem solving through research approaches and related to the structure and development of plant generative topic, therefore the expected learning outcome is a writing skill.

Table 1. Non-randomized pretest-posttest control group design

Group	Pretest	Treatments	Posttest
K	T_1	X_1	T_2
E	T_3	X_2	T_4

Note: K = control group; E = experiment group; X_1 = PjBL; X_2 = PjBL integrated information literacy rubric

The measured learning achievement was students' writing skills using the rubric for a research project in education which is adapted from Wolf and Stevens (2007). The rubric itself contains eight aspects namely abstract, introduction, methods results, discussion/conclusion, limitation, references, and written report. Every aspect consists of three indicators (beginning, proficient, and advanced) including a description for each indicator. The data were analyzed using descriptive and inferential analysis. The inferential analysis was used to test the students' research hypothesis. The inferential analysis used the ANCOVA test with the prerequisite test namely homogeneity (Levene's test) and normality (Shapiro-Wilk) test. Descriptive analysis was used to describe the students' learning outcomes. Also, questionnaires were given to understand students' responses toward the information literacy rubric. The rubric consists of three opened-question which asked how do students feel by using the rubric in the PjBL, do they find the rubric gave wether advantages or disadvantages, and what do they use the rubric for.

RESULTS AND DISCUSSION

The result of the homogeneity and normality test is presented in Table 2 and Table 3, respectively. The homogeneity result shows that Sig. value 0.313 > 0.05, this means that the data is homogeneous. Table 3 shows that the data distributed normally with the Sig. value is 0.61 > 0.05.

Table 2. Homogeneity test results

F	df1	df2	Sig.
1.026	1	118	0.313

Table 3. Normality test result

N		120
Normal Parameters [a,b]	Mean	.0000
	Std. Deviation	4.81630
Most Extreme Differences	Absolute	.079
	Positive	.046
	Negative	-.079
Test Statistic		.079
Asymp. Sig. (2-tailed)		.061[c]

Table 4 shows a summary of the ANCOVA test results in the control and experiment group. The results of the ANCOVA test is less than 0.05, this means that the null hypothesis rejected and the research hypothesis is accepted. In other words, the information literacy rubric used in the experimental group affects the students' learning outcomes. Furthermore, Table 5 shows the corrected average students' learning outcomes in the experimental group amounting to 75.911% while in the control group were 66.489%. These findings indicate that the empowerment of learning outcomes with information literacy rubric assessment in the experimental

group is better than in the control group. These results also supported by the improvement of students' learning outcomes percentage in the experimental group which is higher than the control group.

Table 4. Summary of ANCOVA test results in experimental and control group

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6308.783[a]	2	3154.391	133.699	0.000
Intercept	3311.249	1	3311.249	140.347	0.000
XHBK	3601.283	1	3601.283	152.640	0.000
Class	2663.597	1	2663.597	112.896	0.000
Error	2760.417	117	23.593		
Total	617402.000	120			
Corrected Total	9069.200	119			

a. R Squared = .696 (Adjusted R Squared = .690)

Table 5. Comparison of corrected average learning outcomes in experimental and control group

Group	Pretest	Posttest	Difference	Corrected Average
Experiment	54.75	75.950	21.200	75.911
Control	54.63	66.450	11.817	66.489

Based on these comparisons, it can be seen that the application of information literacy rubric assessment can improve learning outcomes compared to the control group. According to Soleymani (2014) there was a link between information literacy and student academic success at Isfahan University of Medical Sciences. Other research was conducted by Julien, Detlor, Serenko, Willson, and Lavallee (2009b, 2009a) showed that there is an influence between information literacy and student learning outcomes. Flierl et al. (2018) argue that giving student assignment to synthesize information and communicate results throughout one semester are correlate positively with academic achievement. The results of the ANCOVA test show that information literacy influences learning outcomes. Besides that, it is found that the average corrected learning achievement of students in the experimental group is higher than control group. These findings indicate that the empowerment of learning outcomes with information literacy rubric assessment in the experimental group is better than students in the control group without it.

The task given for students in one semester in the Structure of Plant Development course was to compile scientific articles. However, based on the results of previous research shows that students are still not trained and therefore need effort through information literacy (Saptasari et al., 2018). Klucevsek and Brungard (2016) declare that to be able to write in compiling scientific articles, students must develop skills in information literacy. Information literacy treatment in the experimental group with a rubric to assist students in completing assignments. The research is following Rapchak, Brungard, and Bergfelt (2016) opinion that rubric is used as a formative assessment to help students in the learning process. Authentic assessments of the tasks applied will make students possess not only content mastery but also the ability to use content knowledge in problem-solving. Other research shows that the use of formative assessment rubrics can improve critical thinking skills (Visande, 2014). Thus, the utilization information literacy as formative assessment may also help students identify their strengths and weakness and the target areas that need to be worked on (Andersson & Palm, 2017; Hansen & Ringdal, 2018; Wilson, Roscoe, & Ahmed, 2017; Xiao & Yang, 2019; Zainuddin et al., 2020). In addition, student's will improve their learning outcome because of the teacher can recognize where students are struggling and address problems immediately.

The results of the descriptive analysis revealed that students showed an active learning process in carrying out tasks from information literacy rubric assessment such as identifying the extent of information needed, accessing and evaluating information. Detlor et al. (2012) stated that the application of information literacy is an active learning strategy because through information literacy rubric students analyze, synthesize, and evaluate information to support the achievement of student learning in the classroom. The result also indicated that students in the experimental group experienced some benefits from using the information literacy rubric assessment. Generally, there are three benefits and its percentage which can be seen in Figure 1. Findings from student responses indicate that the use of rubric information literacy provides several benefits for students such as: (1) giving clear instruction guidance; (2) assessing individual achievement; and (3) motivating better performance. Laurian and Fitzgerald (2013) said that rubric directed at helping lecturers and students to assess their learning, thus a student can improve their learning formally. The use of rubrics is essential when working with complex learning processes. Rapchak et al. (2016) emphasizes that the rubric used according to the project learning model allows students to assess their assignments directly and the purpose is to determine the learning outcomes. In line with the finding of Bennett (2011) that identified the key of formative assessment strategies which were said to be effective in improving learners' achievement including (1) clarifying and

sharing learning intentions and criteria for success; (2) providing feedback that moves learners forward; (3) activating students as the owners of their learning (self-assessment); and (4) activating students as instructional resources for one another (peer assessment).

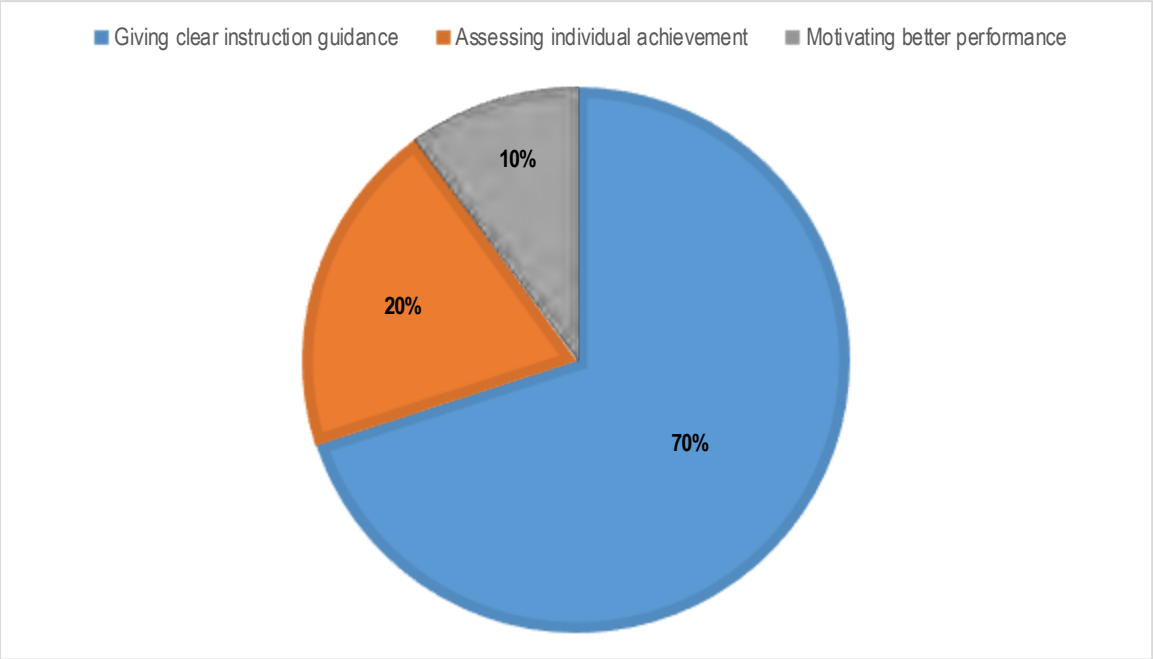

Figure 1. Percentage of student's responses toward the benefits of using information literacy rubric assessment

The implementation of the information literacy rubric assessment used consists of three criteria: 1) beginning; 2) proficient; and 3) advanced. The results obtained from students, in general, are still at the beginning of the indicator because it needs to integrate into several other subjects to help develop students' intellectual abilities. At the beginning of the sign has a concept to connect science with other disciplines, student can write scientific terms, but they still have misunderstandings (Fakhriyah, Masfuah, Roysa, Rusilowati, & Rahayu, 2017). According to Flierl et al. (2018) the relationship between information literacy and student achievement varies based on the rating scale. The range of studies of small-scale investigations offers in detail how students use information for specific tasks and large-scale studies related to library resources. The results of this research showed that PjBL which was integrated with information literacy rubric had a significant impact on biology students' learning outcomes. However, it is suggested that educators should provide a proper strategy as an effort to support their students' learning outcomes.

CONCLUSION

The results showed that Project-Based Learning which was integrated with the information literacy rubric had a significant impact on biology students' learning outcomes. There are differences in the enhancement of student's learning outcomes between the experiment group and the control group. The experiment group which used PjBL integrated with information literacy rubric assessment had better learning outcomes enhancement than the control group which just used PjBL. The results showed that the use of information literacy rubric assessment affected the student learning outcome with a corrected average is 75,911. Based on the findings, it is suggested that educators should provide a proper strategy as an effort to support their students' learning outcomes.

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