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The Effect of Project in Problem-Based Learning on Students' Scientific and Information Literacy in Learning Human Excretory System

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ABSTRACT The present study aims to investigate the effect of Project in Problem-Based Learning on students' scientific and information literacy in grade 8 studying in one of the private schools in Bandung in the human excretory system topic. A sample of 39 students in two classes was selected purposively from the five classes available in the school. An experimental group comprising 19 students received the instruction by Problem-Based Learning with the project at the end of the lesson while the control group comprising 20 students received the human excretory instruction by using Problem-Based Learning without a project. The data was collected via the pre-test and post-test administration. The results were statistically analyzed using SPSS software by employing an independent t-test. Results indicated that after the one-month treatment period, students in the experimental group have a higher score in the scientific literacy test compared to the students in the control group even it was not significantly different. Therefore, the results of students' information literacy showed that there was a significant difference between the experiment and control group. It is concluded that Project in problem-based learning is useful to conduct as the learning strategies in the classroom to improve students' scientific and information literacy.

Keywords Project in Problem-based learning, Scientific literacy, Information literacy

1. INTRODUCTION

Science is considered one of the hardest subject matters in school. It requires many theoretical readings, calculation, and formulas, difficult terms, and content memorization. According to Cimer (2012), students have difficulties in learning biological concepts because of the nature of science itself, its teaching methods, and lack of facilities, media, and resources. While in learning chemistry, Cardellini (2012) stated that students have difficulties in chemistry because of the nature of science, the methods of teaching, and the methods by which students learn. Whereas students have difficulties in learning physics because of the nature of physics, the way in which a physics course is taught, and the physics problems which are sometimes very vague and cumulative (Ornek, Robinson, & Haugan, 2008). Those factors make students pay less attention in the class, easily lose concentration, feel bored, and uninterested in learning science.

The nature of science becomes one of the reasons why sciences are hard and difficult to learn. The nature of biology usually includes a lot of concepts, various biological events that cannot be seen by the naked eye, abstract concepts, and there are a lot of foreign / Latin words. These nature of biology leads them to memorize the biological facts in order to learn them (Cimer, 2012). The nature of chemistry tends to the alphabetic and symbolic language, abstract concepts, and structural properties which couldn't be seen by the naked eyes (Cardellini, 2012). The nature of physics composed of many theoretical readings (such as laws and rules), alphabetic language, formulas and calculations that requires good mathematics, very abstract things, and hard to grasp the next concept when one of the concepts is missing (cumulative) (Ornek, Robinson, & Haugan, 2008). Thus, the nature of science requires very detailed knowledge and covered topics or concepts that were difficult to learn. When this topic does not appear to be relevant to the students' daily lives and does not include practical work or experiments, students will learn the topic by memorization (Cimer, 2012).

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The way the teacher taught is another common reason behind "science is hard". According to the Cimer (2012), science lessons are generally carried out through the teacher-centered lesson. Teacher transfer the knowledge that they have without involving students in the classroom activity. The concept is also rarely connected to the daily lives so that students losing their motivation to learn science. As a result, science lesson becomes boring and uninteresting for students.

The role of the teacher becomes an important part to help students in learning science, especially in the way they deliver the concept (teaching strategy). The teaching strategy is an important thing to create an environment in the classroom become more active, engaging, and increasing the students' participation. Fives, Huebner, Birnbaum, & Nicolich (2014) stated that science should be a recursive, dynamic process of asking questions, investigating, and then asking more questions. Akinoglu & Tandogan (2007) suggests that the student-centered active learning process within will makes students take the responsibility and involvement in the learning process. Active-learning techniques motivate students and maintain their attention by requiring them to engage in course content (Wenger, 2014). There are a lot of teaching strategies that can be used in the science teaching and learning process, such as Discovery-Based Learning, Problem Based Learning, Project Based Learning, Inquiry-Based Learning, and so on. These strategies promote student-centered learning in which they will involve in the learning activities.

In order to overcome students' problem in science, the teacher needs a teaching strategy which is able to connect their knowledge with the real-life phenomenon, able to involve them in the classroom activity and reflect on the abstract knowledge. The strategy that meets these criteria is Problem-Based Learning (Akinoglu & Tandogan, 2007). Problem Based Learning is active learning technique that helps students to develop higher-level cognitive abilities, such as critical thinking and problem solving, through collaborative group work and reflection on their own learning (Wenger, 2014). Clayton & Pierpoint (2004) adds that PBL is a student-centered and self-directed learning model which begin the lesson with a problem, not a knowledge. Students will find the knowledge by themselves through a problem they are solved and the teacher acts as a facilitator to guide them to find the solution to a problem (Akinoglu & Tandogan, 2007).

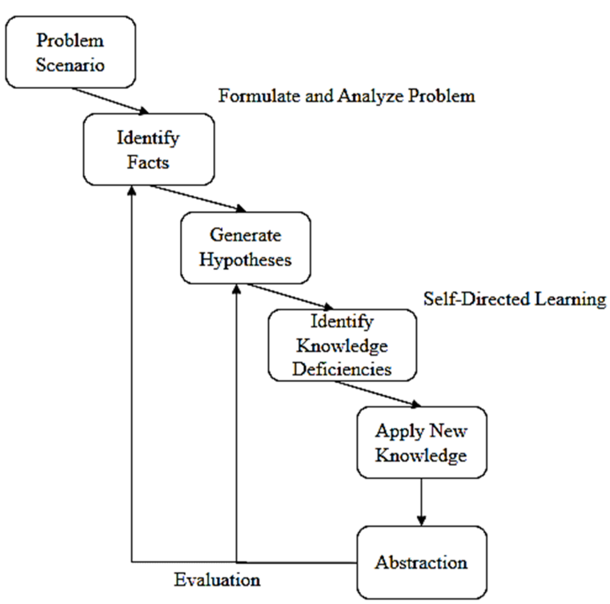

Figure 1 Problem-based learning cycle

In learning by using PBL, there is a cycle which starts with a problem scenario. According to Hmelo, Silver (2004), PBL learning cycle (as shown in Fig. 1) is represented through the instructional process that begins with the presentation of a problem and ends with students' reflection. In this cycle, the students are presented with a problem scenario. They formulate and analyze the problem by identifying the relevant facts from the scenario. This fact-identification step helps students represent the problem. As students understand the problem better, they generate hypotheses about possible solutions. After that, students will identify knowledge deficiencies which are also known as the learning issues where students find the information to solve the problem (self-directed learning). Following SDL, students apply their knowledge and evaluate their hypotheses in light of what they have learned. At the completion of the problem, students reflect on the abstract knowledge gained. Akinoglu & Tandogan (2007) said that by using PBL approach in a learning activity, students will involve more in the process of learning and since they do some research in solving the problem, students will more understand the lesson rather than memorization.

In constructing the theories represented by the problems presented, students work collaboratively using a variety of informational resources (Akinoglu & Tandogan, 2007). The information itself is gained from various media such as books, internet, magazine, or direct interview with the expert. Therefore, it is necessary for students for being information literate so that they would be able to effectively filter information that they get through the Internet, television, newspaper, and other sources. Students also need information literacy so that they are able to locate, evaluate, and use the information effectively and efficiently, especially in science content (Association of College and Research Libraries, 2000).

According to the Montana Office of Public Instruction (2010), there are five standards of information literacy that students may learn in Grade 8. The standards are (i) to identify the task and determine the resources needed; (ii) to locate sources, use information, and present findings; (iii) to evaluate the product and the learning process; (iv) to use information safely, ethically and legally; and (v) to pursue personal interests through literature and another creative expression.

The seeking of science content in many resources is also forced students to have scientific literacy instead of having information literacy. Scientific literacy itself is the ability to understand scientific processes and to engage meaningfully with scientific information available in daily life (Fives, Huebner, Birnbaum, & Nicolich, 2014). However, the implementation of scientific literacy itself has not been a concern in all countries, such as in Indonesia. This statement is supported by the data of OECD (2016) which shown that scientific literacy for Indonesian students in 2015 is in the position of 62 from 70 participated countries. This report means that the scientific literacy of the students in Indonesia is still low. The low ability of students' literacy is influenced by several factors, they are curriculum and educational system, the method and model of learning that is used in the instructional process, learning facility, and learning sources (Kurnia & Fathurohman, 2014). The strategies to enhance students' performance in scientific literacy is by engaging them in learning activity which is student-centered such as questioning, creative exploration to find the answer, and the communication skills to present the result (Latip & Permanasari, 2015).

2. METHOD

This research used the quasi-experimental method. In quasi-experiments, the researcher cannot artificially create groups for the experiments so researcher uses the group (class) that the school already arranged to take data (Fraenkel, Wallen, & Hyun, 2012). The dependent variable of this study was students' scientific and information literacy while the Project in Problem-Based Learning is the independent variable.

A non-randomized group pre-test-post-test design was used for this study. According to Creswell (2012), the study can apply pre-test and post-test design when using a quasi-experiment as the method. The classes were randomly assigned to the experimental and control group. This study will conduct the same pre-test to the control and experimental group with the same pre-set questions. Then, the experimental group will have Project as the treatment and get a module of information literacy, while control group only have a regular problem based learning without any project and have direct instruction of information literacy. The treatment was implemented in two weekly lessons of 5 hours each. In the first meeting, both groups conducted the same pre-test on a different day. Then in the second meeting, both groups conducted the learning topic by using Problem-based learning and got a module of information literacy in the experimental group and direct instruction of information literacy in the control group. The lesson was given on a weekly basis in the period of March 2018. In the third meeting, the experimental group has guidance to create a project in the form of an article

Treatment group	*M*	*O*	*X*	*O*
Control group	*M*	*O*	*C*	*O*

Figure 2 The matching-only pretest-posttest control group design

about the human excretory system. While the control group makes a summary of diseases of the human excretory system. Pre-test data on scientific and information literacy multiple-choice questions were collected before the students learn about the human excretory system topic. Post-test data on the same variables were collected a month later, right after the intervention. Data were collected and analyzed by using the Independent T-test on SPSS software.

Both the control and treatment group subjects have been matched. The M in this design means that both groups have the same start point or the equivalent level of achievement (see Fig. 2). This was proven by the p-value on the pre-achievement test in both scientific and information literacy which showed a p-value > 0.05. Then, after the subjects had been matched, they have conducted the same pre-test. The subjects in the treatment group were conducting the human excretory system by using PBL model with project-based information at the end of the class meeting. Project-based Information refers to the article about a human excretory system which they sought the information freely on many resources. The PBL was combining with the project in order to encourage students to construct and make connections between their knowledge and its application in daily life through the information that they gathered. That information will be compiled in an article as the project based information. The students were guided by the module of information literacy made by the teacher. In another hand, the control group was conducting the learning with the PBL model without project-based information at the end of the class meeting. Instead of taught by PBL model, students in the control group were also got the direct instruction about the information literacy.

All participants were 8th-grade students attending the one of private secondary school, located in the city of Bandung, comprising 110 students in 5 classes. The school works on the basis of the *Kurikulum* [Curriculum] 2013 developed by Indonesia Ministry of Education and Culture. The samples were two classes of 8th grade. The experimental group consisted of 19 students (11 females and 8 males) and the control group consisted of 20 (11 females and 9 males) students. The age of the sample was about 14 years old. The sampling technique used was purposive sampling because the researcher needs two classes with the same average score in science since the research is using quasi-experiment.

The instruments used in this research is an objective test. The objective test is used to evaluate students' students scientific and information literacy in learning the

Table 1 The results of the detached t-test carried out regarding the difference between the pre-test scores of students in the experimental and control group

Group	N	M	SD	SE	Detached group t-test		
					df	t	p
Experimental Group	19	35.16	11.437	3.508	37	-0.558	0.58
Control Group	20	33.20	10.471				

Table 2 The results of the detached t-test carried out regarding the difference between the post-test scores of students in the experimental and control group

Group	N	M	SD	SE	Detached group t-test		
					df	t	p
Experimental Group	19	65.47	14.860	4.494	37	-1.975	0.056
Control Group	20	56.60	13.189				

human excretory system. The objective test is given in a form of multiple choice. The study administered 40 multiple choice test items of scientific literacy and 40 multiple choice test items of information literacy, then it would be discussed and selected based on the analysis result of the pilot-test instrument. Total question number that will be used for pre-test and post-test are 25 questions for scientific literacy and 25 questions for information literacy which each multiple-choice item is given a numeric value of one to correct answer and zero for incorrect.

3. RESULT AND DISCUSSION

The results show quantitative data. The pre-test and the post-test are conducted to determine the students' understanding before and after treatments.

3.1 Scientific Literacy

An independent samples t-test was conducted to compare the students' scientific literacy achievement in control and experimental class. Table 1 showed that there was a not significant difference in students' pre-scientific literacy achievement scores for control group (M=33.20; SD=10.471) and students in experimental group (M=35.16; SD=41.75; t(37)=-0.558, p=0.580, two-tailed). The 95% confidence interval for the difference in means ranging from -9.067 to 5.151. Hence non-significant which means students in both the groups had an equivalent level of achievement of scientific literacy.

After the intervention in a month, students were conducted a post-test. An independent samples t-test was conducted to compare scientific literacy scores for students in the control and experimental group. Table 2 showed that there was not a significant difference in scientific literacy scores for students in the control group (M=56.60; SD=13.189) and students in the experimental group (M=65.47; SD=14.860; t(37)=-1.975; p=0.056, two-tailed). The 95% confidence interval for the difference in means ranging from -17.979 to 0.231.

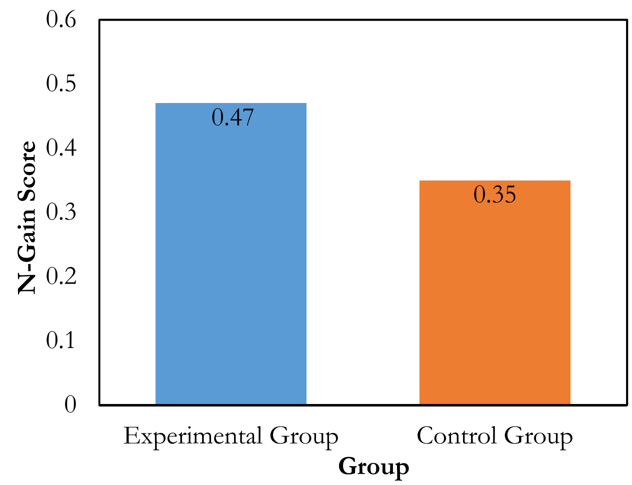

Figure 3 The normalized gain scores of students' scientific literacy

Since the post-test in scientific literacy showed there is no significance, the researcher uses N-gain to investigate the improvement in achievement of scientific literacy score. The score gained from the calculation of N-Gain in the experimental group was 0.467 and control group was 0.350 as seen in Figure 3. The score obtained according to Hake (1999) is included in the medium range. From the N-Gain score of the achievement of scientific literacy score, it can be concluded that there is an improvement of students' achievement scientific literacy score after the treatment by using Project in problem-based learning.

The implementation of Project in PBL and the regular PBL learning model can improve students' scientific literacy skills in aspects of content knowledge, science competencies, and attitude in the medium category of N-Gain. This is influenced by several factors of (i) the number of students who participate in both experimental and control group were big so that it took too much time to help them find out the concept or problem solving; (ii) the number of meeting and time in each meeting are limited. To conduct this topic, researcher was only has five hours to deliver all the concept material with 50 minutes in every hours so it was so difficult for teacher to review all the concepts after student solved the problem; (iii) the content provided by the school was varies and students should learn all of them (structure and function of human digestive organ, the mechanism of excretory system in excretory organ, the diseases in human excretory system, the effort to maintain the health of excretory organ) within 5 hours of meeting; (iv) the attendance of students were also influenced the result. Since there were only 2 meetings so that when students not participating in a day meeting in a class they were like missing half of the concept.

The students' scientific literacy in each aspect has also improved well. From Figure 4, it showed that the knowledge domain, the improvement of scientific literacy's achievement after conducting an intervention was 24% in the experimental group and 15% in the control group. In

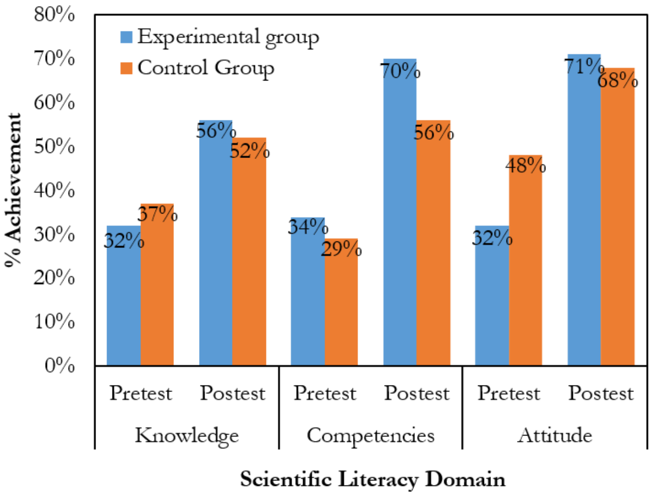

Figure 4 The scientific literacy achievement percentage in every domain

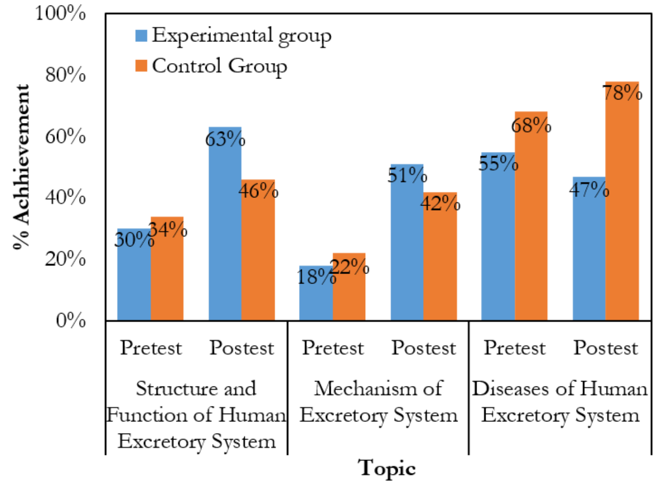

Figure 5 Profile of improvement content mastery achievement of human excretory system after learning process using PBL models

the competencies domain, the improvement was 36% in the experimental group and 27% in the control group. Whereas in attitudes domain, the improvement was 39% in the experimental group and 20% in the control group. The results showed that the highest improvement in the experimental group was in the attitudes domain with 39% and in the control group was in competencies domain with 27%.

Analysis of scientific literacy knowledge conducted to determine the profile of Human excretory system material mastery. The human excretory system is divided into four topics of structure and function of the human excretory organ, the mechanism of the excretory system in every excretory organ, and the diseases of the human excretory system. Figure 5 shows the improvement in students' achievement for every content material that was discussed in the learning process. Overall, Problem-based learning whether or not using a Project, it can improve science content mastery achievement. In the sub-topic of the structure and function of the human excretory system, there was an improvement of about 33% in the experimental class and 12% in the control class. In the mechanism of the excretory system, there was an improvement of about 33% in the experimental class and 20% in the control class. In the sub-topic of diseases of the human excretory system, there was an improvement of about 10% in the control group while in the experimental group the score decreased by about 8%. The highest improvement was in the structure and function of the human excretory system for the experimental group that uses Project in PBL and diseases of a human excretory system for the control group who doesn't use Project.

Results of students' activity observation showed that the dominant activity during the learning process with Project with and without PBL was the discussion and students' observation. This means that those activities conducted by students contributed positively to students' understanding of these content. In the discussion process, students got the worksheet contained problems related to the topic. Students were having a discussion and have some exploration due to solving the problems. After the discussion activity was completed, the teacher also gave review related to the problem presented about those content material through questioning. This is in line with Inel & Balim (2010) who stated that the use of the Problem-based learning method in science is more effective in enhancing students' academic achievement because the active role played by the students in the process of PBL from the problem identification to solving the problem and by constructing their own knowledge in the collaborative group.

Besides students' knowledge domain, this study was also examined students' thinking competence after obtaining science learning using Project in PBL models. According to Ardianto & Rubini (2016), a person said to be literate when he is not only proficient with conceptual terms, but also their way of thinking to solve the problem using their knowledge. Student competence revealed in this research to the scientific literacy indicators recommended by the Programme of International Student Assessment (PISA) in 2015. They are "Identifying scientific issues", "Explaining phenomena scientifically", and "Using scientific evidence". Overall performance shows improvement of students' science knowledge after using PBL models in science learning can be seen in Figure 4.

Figure 6 shows that the achievement of students' science competencies overall showed encouraging results. The research revealed that the indicator of "explain phenomena scientifically" improved 32% for Project in PBL and 34% for PBL only. Then for the indicator of "Identifying science issues: it improved 58% for the experimental class and 25% for the control class. And for the indicator of "Using scientific evidence, it improved 35% for the experimental class and 21% for the control group.

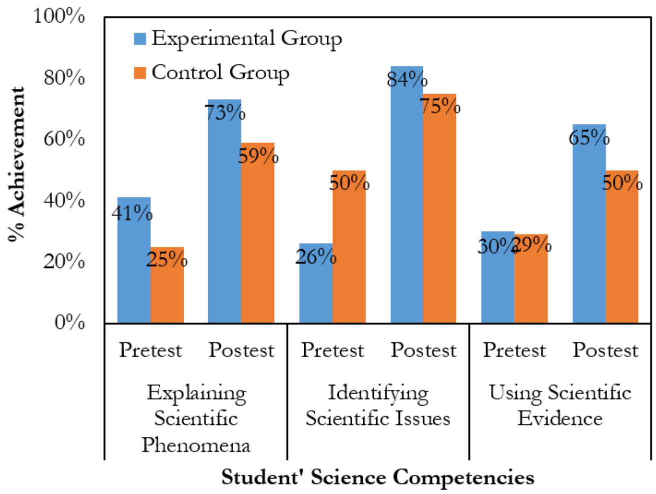

Figure 6 Improvement of student' science competencies after using PBL with and without project in science learning

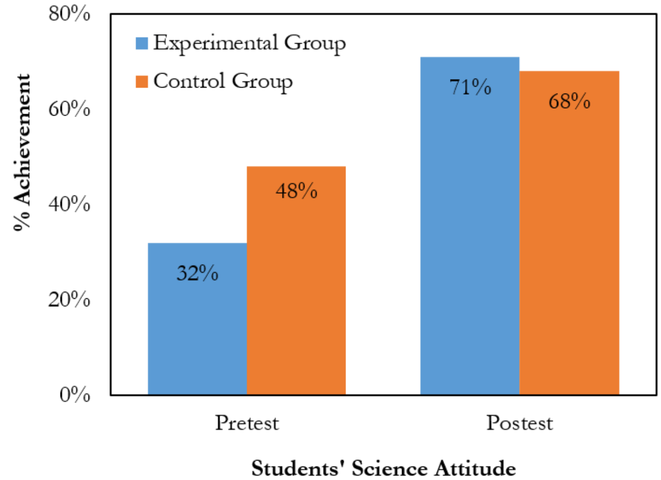

Figure 7 Improvement of students' science attitude after using PBL models in science learning

The improvement of students' competence in each indicator was because the implemented learning model emphasized students' independence and thinking skills. Basically, the model is applied in the classroom to give students an opportunity to practice recognizing scientific issues in the learning process to solve the problems. This is in line with the research finding of Ardianto & Rubini (2016) that revealed students' science competency can improve through the learning process using guided discovery and Problem-based learning by solving problems through systematic stages.

Students' attitude revealed in this study refers to the scientific literacy indicators of "Environmental awareness". Overall performance shows improvement of students' attitude after using PBL in science learning can be seen in Figure 7. Figure 7 shows that the achievement of students' science attitude was encouraging results. The research revealed that the indicator of environmental awareness improved from 32% to 71% (39%) in the experimental group and from 48% to 68% (20%) in the control group. The improvement of students' science attitude was because the implemented learning model emphasized the daily life phenomenon and active learning in a collaborative group. This is in line with Akinoglu & Tandogan (2007) that the attitudes of students in PBL group showed the positive effect rather than the conventional group because the PBL provides scenario content related to daily life which removing students fear about the difficult problem-solving, facilitating learning, and making students be aware of the fact that science is a very part of life. Besides, since the PBL instruction needs students' collaboration with the group, students' cooperation and social development were also influenced positively.

The improvements in scientific literacy aspects occurred because of the Problem-based learning itself encourage students to construct their own knowledge by solving a problem in daily life. This is consistent with the research of Akinoglu & Tandogan (2007) that PBL can develop the content knowledge of students by solving the problem related to the real-world phenomenon. Baden, Manggi, Major, & Claire (2004) is also stated that Problem-based learning uses problem scenarios to encourage students to engage themselves in the learning process. Another research by Ardianto & Rubini (2016) suggests that Besides, the improvements of scientific literacy occurred because the integrated science lesson by using PBL model could encourage students to construct and make connections between their knowledge and real-life phenomenon.

The implementation of PBL models in the learning activity also gave the opportunity to students to work together with other groups in doing an investigation, so that it can develop their learning process and social skills. This is in line with the result of the research of Akinoglu & Tandogan (2007) which stated that since PBL instruction needs the collaboration of groups, the students' cooperation and social development were also influenced positively. Another research conducted by Inel & Balim (2010) showed that the use of the Problem-based learning method in science and technology teaching is more effective in enhancing students' academic achievement than conventional method because the active role played by the students in the process of PBL from the problem identification to solving the problem and by constructing their own knowledge in the collaborative group. Ajai, Imoko, & O'kwu (2013) also added that PBL deals with collaborative groups in which students were able to compare and evaluate their understanding of subject matter with other understanding so that it can improve their achievement.

3.2 Information Literacy

An independent t-test was conducted to compare information literacy pre-test score in the experimental and control group. Table 3 showed that there was no significant

Table 3 The Results of the detached t-test carried out regarding the difference between the pre-test scores of students' information literacy in the experimental and control group

Group	N	M	SD	SE	Detached group t-test		
					df	t	p
Experimental Group	19	27.79	14.860	3.429	37	1.228	0.227
Control Group	20	32.00	13.189				

Table 4 The results of the detached t-test carried out regarding the difference between the post-test scores of students' information literacy in the experimental and control group

Group	N	M	SD	SE	Detached group t-test		
					df	t	p
Experimental Group	19	60.84	14.860	5.022	37	-2.159	0.037
Control Group	20	50.00	13.189				

difference in information literacy scores for students in experimental group (M=27.79; SD=14.860) and students in control group (M=32.00; SD=13.189; t(37)=1.228; p=0.227, two-tailed). The 95% percent confidence interval for the difference in means ranging from -2.737 to 11.159. The non-significant result in pre-test means in both the groups had an equivalent level of achievement of information literacy.

After conducting an intervention during a month period, an independent t-test was conducted to compare students' information literacy post-test scores for students in the experimental and control group. Table 4 showed that there was a significant difference in information literacy scores for students in experimental group (M=60.84; SD=14.860) and students in control group (M=50.00; SD=13.189; t(37)= -2.159; p=0.037; two-tailed). The 95% confidence interval for the difference in means ranging from -21.017 to -0.668. The result indicates that the implementation of the Project was able to be used in improving students' information literacy.

Other results come from the information literacy in each standard. There were three standards by Montana Office of Public Instruction (2010), those are "identify the task and determine the resources needed", "locate sources, use information, and present findings", and "use information safely, ethically, and legally". As seen in Figure 8, the results of students' achievement of Information literacy in every standard were improved. For the "Identify the task and determine the resource needed" standards, the experimental group was improved by 38% and the control group was 25%. The standards of "Locate sources, use information, and present findings" for the experimental group was improved by 27% and 16% for the control group. Then, for the standards of "Use information safely, ethically, and legally" was improved 31% for the experimental group and 32% for the control group. Basically, all the standards in both groups were improved but for students who have Project in PBL has higher improvement.

The analysis of standard "Identify the task and determine the resources needed" conducted by three goals recommended by Montana Office of Public Instruction (2010), those define the problem, identify the information resources needed, and evaluate and select appropriate resources. As seen in Figure 9, every goal of the standard has improved well. The low improvement was is the goal of identifying the information and resources needed. It happened because, in this goal, students should remember about the first, second, and third source of information. Students understand its definition but still confuse in the examples of first, second, and third sources so that the improvement is still low.

The analysis standard of "locate sources, use information, and present findings" conducted by two goals

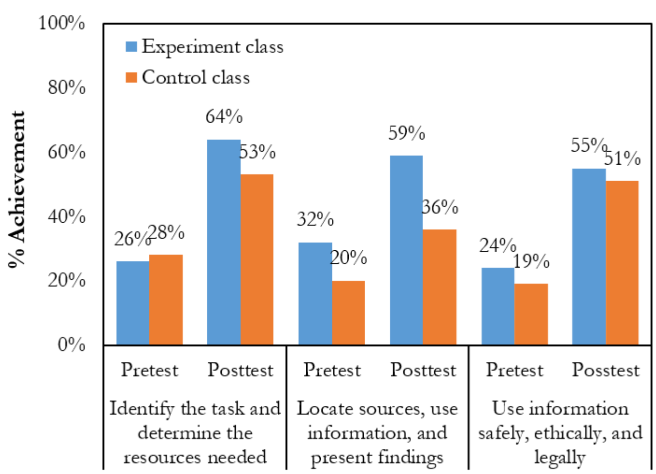

Figure 8 The students' achievement of information literacy in every standard of montana standards of public instruction

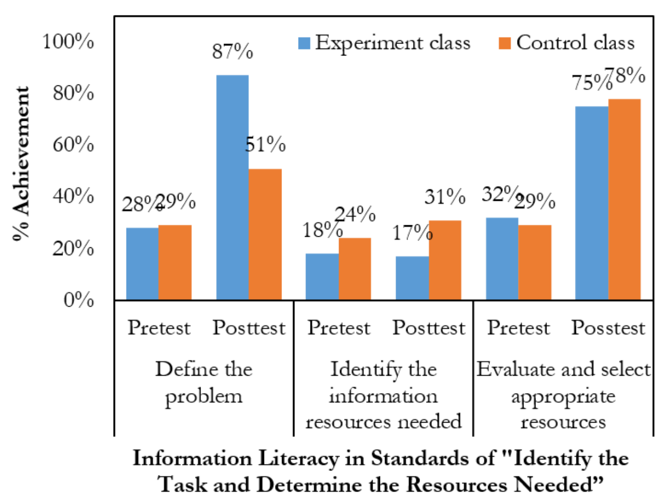

Figure 9 Profile of improvement students' information literacy in standards of "identify the task and determine the resources needed"

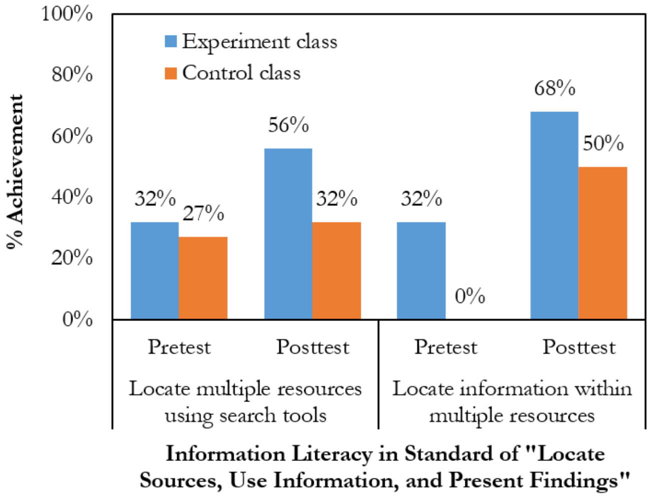

Figure 10 Profile of Improvement Students' Information Literacy in Standard of "Locate Sources, Use Information, and Present Findings"

to locate multiple resources using search tools and locate information within multiple resources. Overall, the goals of this standard have improved. As you can see in Figure 10, the improvement of the goal of locating multiple resources using search tools was 24% for the group who conduct Project and module, while the control group who got direct instruction of information has improved 5%. Another goal that locates information within multiple resources has improved students with Project and information module in 36% and the group with direct instructional information was improved by 50%. This improvement occurred because students directly practice locating the information they need to solve the problem trough exploring the various resources. This is in-line with the research finding of Wenger (2014) which stated that the PBL can help reemphasize the important aspects of information literacy by integrating information literacy into a course provided a way to actively engage students and to help students understand how the information resources fit into their assignments.

The standard of "Use information safely, ethically, and legally" consisted of three goals of (i) legally obtain, store, and disseminate text, data, images, or sounds; (ii) appropriately credits ideas and works of others; and (iii) participate and collaborate in intellectual and social networks following safe and accepted practices. Basically, all the goal has improved well as seen in Figure 10. The first goal was improved by 29% for the experimental group and 57% for the control group as seen in Figure 11. The second goal was improved by 27% for the experimental group and 2% for the control group. The third group was improved by 40% for the experimental group and 55% for the control group. The lowest improvement occurred for both groups in the second goal that is appropriately credited ideas and works of others. This happened because, in this goal, students learn about how to cite in an appropriate way

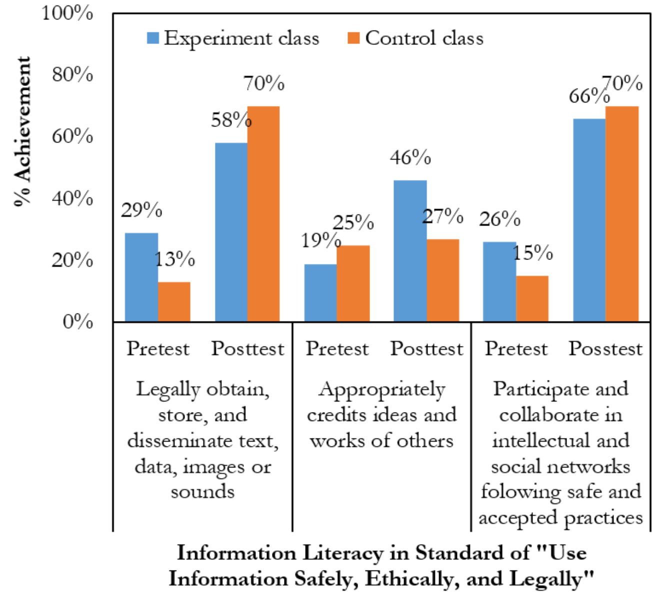

Figure 11 Profile of Improvement Students' Information Literacy in Standard of "Use Information Safely, Ethically, and Legally"

based on the right structure but confused about the structure of the reference itself. They were also not put the citation when the teacher was not asked to do so. This is a bit in line with the result finding of Shultz & Li (2016) who stated that the information literacy skills of the students are not improved through Problem-based learning and one of the reason because students were also not cited any reference in the provided worksheet when the teacher didn't ask them to do so. However, students' achievement of information literacy was improved significantly which means that the implementation of Project in PBL with the information module was able to improve students' information literacy rather than just using PBL with direct instructional information.

Improvements in information literacy aspects occurred because students should find the information about the human excretory system by themselves at the end of the class meeting. The information they gathered will be compiled in an article as the project based information. This activity encourages students to construct and make connections between their knowledge and its application in daily life. This is contradicted with the result finding of Shultz & Li (2006) who stated that the information literacy skills of the students are not improved through Problem-based learning. But, in the research of Diekema, Holliday, & Leary (2011) stated that Problem-Based Learning was an effective approach for some students by working on authentic problems, engaged deeply with information, summarize the information they found, assess its logic and validity in context, and then apply it to adapt their research strategy and create a better understanding based on their opinion. Another research by Wenger (2014) also in line with the result of the study who stated that using PBL to integrate information literacy into a course provided a way to actively engage students and to help students understand how the information resources fit into their assignments.

4. CONCLUSION

This study concluded that the Project in Problem-based learning using information module can be used to build students' scientific literacy. The achievements of scientific literacy in the domain of content knowledge, science competencies, and attitude after learning process has improved quite satisfactory, this is because Problem-based learning uses problem scenarios related to real life phenomenon to encourage students to engage themselves in the learning process by working collaboratively.

The implementation of Project in Problem-based learning using information module has also a positive effect on the students' information literacy. The achievements of information literacy in the standards of "identify the task and determine the resources needed", "locate sources, use information, and present findings", and "use information safely, ethically, and legally" has significantly improved than the group Problem-based learning with direct instructional information. Each goal in standards was also showed the satisfying improvement. This is because Problem-Based Learning working on authentic problems engaged deeply with information, summarize the information that students' found, assess its logic and validity in context, and then apply it to adapt their research strategy and create a better understanding based on their opinion. Besides, by integrating information literacy into a course, it provides a way to actively engage students and to help students understand how the information resources fit into their assignments.

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