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The Effectiveness of Problem Based Learning (PBL) Assisted Google Classroom to Scientific Literacy in Physics Learning

Nila Karmila[1,*] Insih Wilujeng[2,] Hadiid Sulaiman[1]

[1] *Master of Physics Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Indonesia*
[2] *Department of Natural Science Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Yogyakarta, Indonesia*
[*]*Corresponding author. Email: nilakarmila.2019@student.uny.ac.id*

ABSTRACT
This study aims to determine the increase in scientific literacy skills in the competence domain of students through the PBL model assisted by google classroom. This type of research is a quasi-experimental study using a pretest posttest control design. The study population was all students of class XI MIA MAN 1 Yogyakarta. The sampling technique used simple random sampling. In this study, the sample used was students of class XI MIA 1. The data collection technique used was a test. Assessment of scientific literacy skills was obtained through a essay test consisting of five questions. There are three indicators of scientific literacy in the measured competency domain, namely identifying scientific issues, explaining scientific phenomena, and using scientific evidence. The data analysis technique used is the n-gain test. The results showed that the increase in students' scientific literacy skills was in the medium category

Keywords: *PBL, Google classroom, Online learning, Scientific literacy*

1. INTRODUCTION

Education aims to educate the nation's life by developing the potential of each student. Efforts to improve the quality of education are both carried out to improve the quality of a nation. The application of education in Indonesia refers to the current curriculum. The implementation of education in learning activities does not only focus on knowledge but also on skills and attitudes, both social and spiritual. The results of student education in schools are seen from their learning achievement which shows a benchmark for students' understanding of the knowledge that teaches during the learning process[1]. Educational emphasis now includes mastery of material and skills [2]. This can be obtained through learning activities at school either in person or online.

Learning activities have several components, including: students, teachers, curriculum, methods, infrastructure, and environment that can affect student learning outcomes [3]. In addition to the above components, learning resources are needed to support the learning process. Learning resources can be obtained from the surrounding natural environment or equipment that is made by yourself [4]. In educational units, there are three things that must be included in the learning process, namely planning, implementing, and evaluating learning. The evaluation results can be used as an indicator of improving the quality of education. This applies to all subjects, including physics.

Physics as part of natural science which has the same essence as the essence of science. Where physics as attitude, process, and product. Physics as an attitude means that studying the concepts of physics has scientific attributes such as curiosity, objectivity, honesty, and responsibility. Physics as a process shown in the acquisition of understanding of physics concepts that require investigation in practicum and observation activities. Physics as a product that has been discovered by scientists includes facts, principles, laws, and theories [5]. The nature of physics should be applied to every lesson in school. This can improve physics learning outcomes if

combined with the right strategy. Learning strategies train students' scientific literacy skills [6]. Science literacy as a measure of the quality of science education [7]. Scientific literacy on the impression of the ability to understand nature, provide commentary, and draw. Besides that, it can identify problems based on scientific concepts, solve using science skills, and can be involved in activities, ideas, or professions related to science [7].

The scientific literacy framework according to PISA at the OECD shows a problem in science skills that encourages students to involve scientific communication between science and technology [8]. Scientific knowledge from scientific literacy is used to identify problems, gain new knowledge, describe scientific phenomena, and draw conclusions based on scientific evidence [9]. This can be related to the experience students have. So that students are able to provide explanations, descriptions, and predictions of a phenomenon through proper arguments. The scientific literacy indicator in this study emphasizes the competency domain which consists of aspects of explaining scientific phenomena, planning investigations, and interpreting data.

The results of the 2018 International Student Assessment Program (PISA) survey based on data from The Organization for Economic Cooperation and Development (OECD) 2018, Indonesia ranked 70 out of 78 countries in the science category [7]. This shows that the students' understanding of science is low. Physics is part of the material tested in the science category. So that efforts are needed to build students' scientific literacy skills. The results of observations in MAN 1 Yogyakarta show that physics learning is more teacher-centered, students tend to be passive during the learning process, less involved in the environment, and evaluation of mastery of the material has not involved scientific literacy skills. So that we need a method that encourages the active role of students in solving physics problems and scientific literacy training. One learning model that can be applied is Problem Based Learning (PBL).

The PBL model in learning activities encourages the active role of students to solve daily problems. The implementation of PBL leads to problems that are authentic in everyday life and meaningful for students [10], [11]. PBL supports students to understand the concepts and principles that bridge between these concepts so as to improve conceptual development and correct misconceptions [12]. In addition, PBL can increase the high curiosity of students which leads them to find solutions to problems so that it has an impact on increasing achievement [12], [13]. The steps of the PBL model include problem-oriented, organizing students, planning research, conducting investigations, developing and presenting experimental results, as well as reflecting and evaluating the problem-solving process. The PBL model has many advantages, namely focusing on problems in order to encourage problem-solving abilities, building knowledge and assessing their own learning progress, and building students' scientific communication [11]. Therefore, it is hoped that it can improve students' scientific literacy skill.

There is a limitation on learning time at school, so technology is needed that can help the learning process to continue [14]. The use of technology in learning can be used as a medium of communication, simulation, or student evaluation [15]. Online learning or e-learning can improve students' scientific literacy skills [16]. Along with the rapid development of e-learning, learning is carried out with the help of Google Classroom. The Google Classroom application is easily accessible to students and can be used in the learning process [17]. Through google classroom, teachers can create classes, assign assignments, and evaluate assignments on the spot. Students can easily access Google Classroom anywhere and anytime. Google classroom is easy to access using mobile learning. This research is expected to find out the effectiveness of the PBL model assisted by google classroom on the scientific literacy skills of students in light wave material.

2. RESEARCH METHOD

This study used a quasi-experimental design with a one pretest posttest group design. The population of this study were all students of class XI MIA at MAN 1 Yogyakarta in the 2019/2020 school year. The sampling technique used was simple random sampling. The sample of this research is 30 students of class XI MIA 1. Learning takes place online using google classroom media. The data collection technique used was a test consisting of 5 description questions. The question refers to the competency domain scientific literacy indicator. Table 1 describes the indicators of scientific literacy used in the study.

Table 1. Science literacy competency indicators.

Competency	Indicator
Identifying scientific issues	Explain scientific phenomena

Competency	Indicator
Explain scientific phenomena	Make and provide correct predictions
	identify, use, and generate explanations through images
Using scientific evidence	Analyse, interpret data, and draw appropriate conclusions
	Converts data from one representation to another

The data analysis technique used the n-gain test to determine the increase in students' scientific literacy skills. The criteria for increasing scientific literacy skills can be seen using the N-gain equation (1) [18].

$$\text{N-gain} = \frac{\text{Spost-Spre}}{\text{Smax-Spre}} \quad (1)$$

Information:

N-gain : criteria for increasing scientific literacy skills
Spost : post-test score
Spre : pre-test score
Smax : maximum score

Table 2 shows the criteria for increasing students' scientific literacy skills based on the N-gain equation.

Table 2. Criteria for increasing science literacy.

N-*gain* Score	Gain Criteria
N-gain ≥ 0,7	High
0,3 ≤ N-gain < 0,7	Moderate
N-gain < 0,3	Low

3. RESULT AND DISCUSSION

Learning is carried out by applying the Google Classroom assisted PBL model online (online) on light wave material. In preliminary activities, the teacher greets students first and apologizes for filling in attendance with absent names and numbers through the comments column. Then the teacher gives apperception and achieves learning objectives. The obstacle that entered the teacher in apperception activities was the presence of several students entering the class google account so that it interfered with these activities. The core activities are carried out based on the PBL syntactic model.

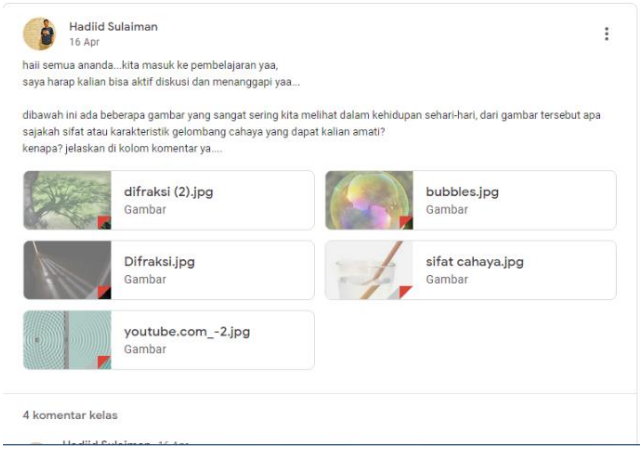

Figure 1 The performance of part menu of GCR

Figure 1 is a display of google classroom used during the learning process. This activity begins with an orientation to the problem. At this stage the teacher presents a picture in the form of an example of light waves in everyday life. Then learners to view and analyze images. Students can forget about pictures through the comments column, then other students can provide feedback. Through this activity students can explain problems in learning. Students understand the problem and formulate questions to solve the problem. This is known as a learning problem [12].

The second stage is organizing students to learn. The teacher gives students worksheets (LKPD) which contains the steps for the PhET simulation experiment. The experiments carried out were double slit interference and lattice diffraction. Students are given time to read the instructional instructions briefly. If there are things that are not applied, students can ask directly to the teacher. Through this activity, the teacher encourages students to ask questions about interference and diffraction events in everyday life. The third stage the teacher investigates the investigation using the PhET simulation. The task of the teacher at this stage is as a facilitator with the involvement of students to carry out simulations and the results. If students experience difficulties, students can ask directly on the column provided. From the simulation activities students can provide an explanation of the simulation simulation picture. Physics problems that arise when carrying out simulation activities must be solved by students themselves. This is done so that students understand scientific phenomena so that they can form new understandings. Therefore the problem is presented in a structured and complex manner [19].

The next stage is to develop and present the results of the simulations that have been carried out. In addition, students are asked to answer questions related to the simulation on the student's worksheet that has been provided. The last stage is analyzing and evaluating the problem-solving process. Students analyze data from independent simulation results. Before the teacher gives an evaluation, one of the student representatives is asked to deliver the simulation results and other students give their responses. After that all students are given the opportunity to discuss which is continued by drawing conclusions together. At this stage of analysis students can explain scientific evidence on one of the phenomena of light waves and determine the factors that influence it.

The research instrument was in the form of descriptive questions which consisted of five items that referred to the competence domain of scientific literacy. This indicator is used to compose problems on the concept of light wave physics. Description questions are needed as a scientific literacy test instrument. This is because the description questions have advantages in measuring the ability of students to identify, make predictions, change representations, and analyze information. Figure 2 is the answers of students before problem-based learning and figure 3 after participating in problem-based learning using google classroom media. Students' answers after learning look more specific, where each process is explained in detail through pictures

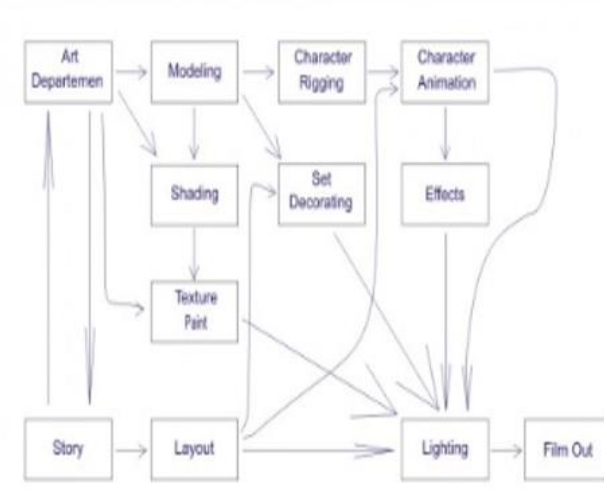

Figure 2 Answers of students before PBL learning

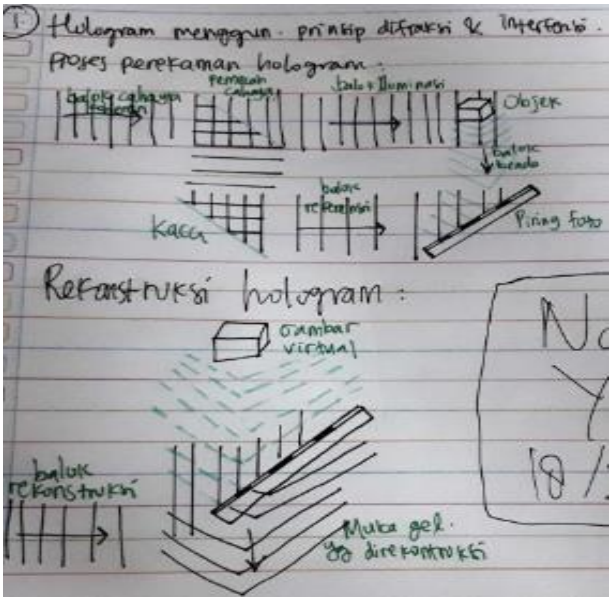

Figure 3 Answers of students after PBL learning

The results of the evaluation of students are divided into each indicator. This prestest result is a percentage of the pretest results of all students. In the indicators of identifying scientific issues, students obtained a pretest percentage of 33 and 60 posttest. In the indicators explaining scientific phenomena, the percentage of pretest 25 and 55 posttests was obtained. Meanwhile, the indicators using scientific evidence obtained the pretest percentages of 61.6 and 83 for posttest. Based on the pretest and posttest values, the n-gain value is 0.47 in the moderate category. Table 3 is the result of scientific literacy on each competency domain indicator.

Table 3. Results of science literacy

Competency	Pre-test (%)	Post-test (%)	N-gain
Identifying scientific issues	33	60	0,49
Explain scientific phenomena	25	55	0,40
Using scientific evidence	61,6	83	0,56
Average	22,1	58,9	0,47

The results showed that indicators using scientific evidence had the highest increase than other indicators. This shows that students are able to give meaning to findings as evidence in order to draw conclusions. In addition, students can state evidence into different forms of representation. The teacher plans activities on the worksheets to encourage students to practice scientific literacy skills. Learning PBL model assisted by Google Classroom can improve scientific literacy skills in the moderate category. Similar research states that increasing scientific literacy skills through PBL encourages students to connect their knowledge with applications in everyday life [20]. So that the PBL model can be applied to scientific literacy skills so that it continues to increase.

The application of google classroom in physics learning makes it easy for both teachers and students. Teachers can create content in no time. Meanwhile students can learn and participate in discussion forums to form knowledge [21]. Through google classroom, students can discuss with other students and teachers online. Evaluation or assignment activities through googe classroom are very effective because they make it easier for students to access assignments and collect these assignments without meeting directly with the teacher. This also makes it easier for teachers to make assessments and provide feedback directly [22]. In the Google classroom rocky learning process students are less actively involved in learning, so the teacher needs to provide encouragement at every step of the lesson. In addition, internet connection disruptions cause websites to run slower.

4. CONCLUSION

The PBL model assisted by Google Classroom in learning shows that there is an increase in students' scientific literacy skills in the competency domain with the moderate category. Students get the highest score on indicators using scientific evidence. online learning is better done with a stable network.

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