The Effect of H-PBL to Improving Student's HOTS and ICT Skills in Physics Learning

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Abstract

This study aimed to analyze the effect of H-PBL to stimulating students HOTS and ICT skills. The model of H-PBL was a combination of online and direct learning. Direct learning was conducted by PBL. During online learning, the students conducted discussion through schoology applications that aimed to increase the ICT skills. The research design in this study was quantitative research with quasi-experimental type, the population that used in this study was students in 1st semester of pattern 6 in State Junior High School 5 Malang, while the sample in this study was 1 experimental class that used learning model of H-PBL and 1 control class that used learning model of PBL. The hypothesis was analyzed using the MANOVA test. The effectiveness of H-PBL learning could be known according to the improvement of learning result before and after using the H-PBL learning model and also could be known by differentiating the learning result of classes which used learning model of H-PBL dan PBL. The result of this study shown that the use of the learning model of H-PBL was proven effective in stimulating HOTS and ICT skills of students in energy materials. The analysis of this study obtained that the score of HOTS in the experimental class was 131.1 and for control class was 99.2, and the score of ICT skills in the experimental class was 18.7 while for control class was 17.8. The result shows H-PBL has effective to stimulated the student HOTS and ICT skill in Physics learning.

Keywords: *H-PBL, HOTS, ICT, Skills*

1. Introduction

Physics is the study of nature and natural phenomena and all the interactions that occur therein. Physics is not only about facts, principles, and concepts, it is not only about a process of obtaining knowledge but about attitudes and scientific processes in the process of obtaining knowledge about nature. Physics is a branch of science that has been able to systematically analyze natural events and phenomena [1]. Generally, learning physics is considered a scary subject and is seen as a difficult subject and students feel heavy when faced with physics problems [2].

Physics as part of a science subject is understood as a subject that demands high-level counting activities so that many students are afraid or do not like physics lessons which results in students being lazy to learn [3].

Learning is a process of activity to obtain, deepen, and use material knowledge. In Industrial Revolution 4.0 learning more emphasizes interdisciplinary and and integrating information technology in the process [4], [5]. In learning physics, the ability to solve students' problems is still low. In working on physics questions given by the teacher, students more often directly use mathematical equations without doing analysis. In learning physics, the ability to solve students' problems is still low. In working on physics questions given by the teacher, students more often directly use mathematical equations without doing analysis [6]. One learning model that presents real problems and emphasizes the use of problems as a means to increase the HOTS ability of students is the Problem Based Learning (PBL) model [7]. The steps in solving a problem that has been carried out by students will be experiences gained from their thinking [8].

Along with the Covid-19 pandemic in various countries and one of them is Indonesia, students are forced to learn from home because face-to-face learning that is usually carried out in schools must be eliminated to break the chain of transmission of Covid-19. Thus, learning can be done online using various existing facilities and supporting media [9], [10]. The use of information technology in the online learning process indirectly has a positive impact on information and technology skills (ICT skills). ICT skills are one of the important skills that society needs in the 21st century, in addition to other skills which include learning and innovation skills, life and career skills. the use of technology in the world of education and the learning process affects the development of educational research that utilizes information technology to support learning, such as e-learning and hybrid learning. On the other hand, in today's technological era, students are required to obtain and evaluate information and how to use it to understand and solve problems [11].

Several research results on e-learning and hybrid learning state that online-based learning can attract students' enthusiasm and increase student achievement. Students think it is time for them to take advantage of technology science to help the learning process [12]. Hybrid Learning is a combination of learning that is carried out in the classroom with learning that is carried out online without having to eliminate face-to-face learning [13]. Through hybrid learning, students are more able to achieve learning objectives than traditional learning, and there can be interactions between students and students and students and teachers.

The development of information technology has an impact on the many e-learning facilities that are easily accessible and used. So that PBL can be applied offline and online by utilizing e-learning facilities. The learning process that has been carried out by collaborating offline and online learning in this discussion is called Hybrid Learning. In a study it can be concluded that the use of the PBL Hybrid model has advantages in improving students' critical thinking skills [14]. However, very few studies use the PBL learning model which is applied offline and online or in this study it is referred to as Hybrid-Project Based Learning (H-PBL) to stimulate students' HOTS and ICT Skills. Therefore, this study was conducted to analyze students' HOTS and ICT Skills, by applying the H-PBL model.

Physics is the study of nature and natural phenomena and all the interactions that occur therein. Physics is not only about facts, principles, and concepts, it is not only about a process of obtaining knowledge but about attitudes and scientific processes in the process of obtaining knowledge about nature. Generally, learning physics is considered a scary subject and is seen as a difficult subject and students feel heavy when faced with physics problems [15]. Several research results on e-learning and hybrid learning state that online-based learning can attract students' enthusiasm and increase student achievement. Students think it is time for them to take advantage of technology science to help the learning process [16].

2. Methods

The research design used in this study is a quasi-experiment, which is when the research process does not allow to control of all other variables that will affect the process of experimenting, thus the other variables are considered the same. The sample in this study was selected based on the Cluster Random Sampling technique, which is a sampling technique from a group of small units. As the name implies, namely Cluster Random Sampling, the sampling is based on clusters or clusters. The population in this study were students in the 1st Semester in State Junior High School of 5 Malang in the 2019/2020 school year. The sample in this study was selected based on the Cluster Random Sampling technique.

Analysis of the effectiveness of H-PBL in stimulating students' HOTS and ICT skills was carried out by comparing 2 classes in the research process, namely the control class and the experimental class. Where the experimental class learned using the H-PBL learning model and the control class learned using the PBL learning model. This study has three variables, namely, one independent variable and two dependent variables. The independent variable is the treatment in learning, namely H-PBL for the experimental class and PBL for the control class. The dependent variables are HOTS and ICT skills.

Sampling was carried out randomly on all sample populations, which is students in the 1st semester. After taking the next sample determine the experimental class and control class. 6.D.1 as an experimental class consisting of 30 students who will learn to use the H-PBL model and class 6.E.1 as a control class consisting of 30 students who will learn using the PBL model.

In this study, there were 3 treatment instruments namely lesson plan, syllabus, and student worksheet. In addition to the treatment instrument, there is also a combined measurement instrument, namely the HOTS questions of students and also the ICT skills questionnaire. Before the data is obtained, it is used to test the hypothesis, then the data must be normally distributed. Because of that, the analysis requirements test was carried out which included the normality test and the homogeneity test. Through the prerequisite data analysis, the post-test data analysis for HOTS questions and the results of questionnaires and the observation of ICT skills as the dependent variable and the learning model were used as independent variables. Testing the hypothesis in this study using the Manova test analysis with a significant level of 5% with the help of the SPSS program.

3. Results and Discussion

The results of the analysis of the effectiveness of H-PBL in stimulating the HOTS and ICT skills of students based on the MANOVA test showed that the significance of the test of between-subjects effects table was 0.00. Because of the significance of 0.00 < 0.05, then H_{01} is rejected. So HOTS of students who learn to use H-PBL is different from students who learn to use PBL. This can be seen because students use the H-PBL model, in addition to face-to-face learning, they also learn through online learning through Schoology, with online media, of course, students are well facilitated so that HOTS physics becomes better, different from students who learn to use PBL which is only face-to-face learning. The difference in HOTS of students, in general, is presented in Figure 1.

Based on Figure 1, the average HOTS score of students in the experimental class that applies the H-PBL model and the control class that applies the PBL model shows that the results of H-PBL are better. This is because the H-PBL learning model can stimulate HOTS through direct or face-to-face online learning. With the help of a hybrid approach, students can carry out discussions online and can be done anywhere and can find other learning sources that can be accessed online. The H-PBL phase which is carried out online can increase students 'interest in learning to increase students' HOTS. Learning by using 2 phases, namely face-to-face and online will further increase the enthusiasm of students to learn, this is evidenced by the positive response of students when online learning is carried out.

In addition to differences in HOTS skills in general, there are also differences in HOTS skills in particular with several indicators, (1) Analyzing, namely solving problems into their constituent parts and detecting the interrelationships of these parts; (1) Analyze (analyze), which is to solve problems into its constituent parts and detect how these parts are related; (2) Evaluate (evaluate), namely making an assessment based on criteria and standards that have been made previously; and (3) Create, namely placing elements to form something new or original. The difference in HOTS based on the indicators is presented in Figure 2.
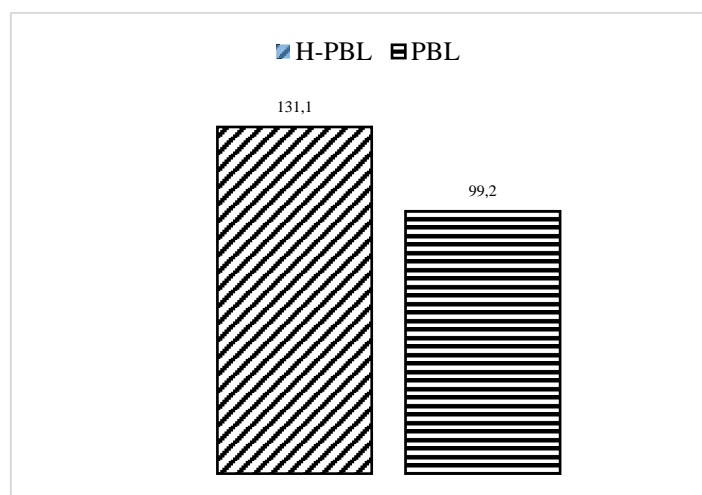
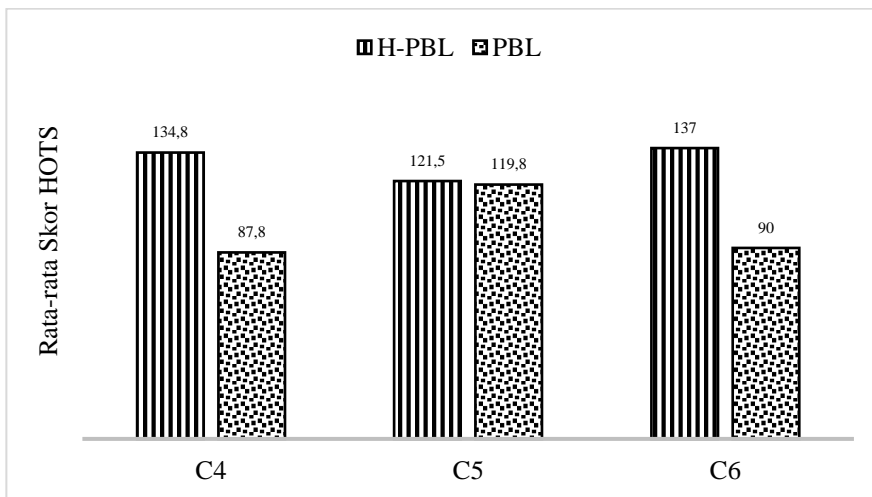**Figure 1.** Students HOTS Score in H-PBL and PBL Learning

Figure 2. Average Score of Students' HOTS in H-PBL and PBL Learning

Based on Figure 2, it can be seen that the first HOTS indicator namely C4 is carried out in the form of description questions. The assessment is given in the form of a posttest. In this indicator, it can be seen clearly that the HOTS results of the class learning with the H-PBL model are much better than the class that learns with the PBL model, which is a difference of 47, this is due to syntax differences in the two models. Based on the results of the MANOVA test analysis using SPSS, it shows that the significance of the tests of between-subjects effects table is 0.028. Because the significance value is 0.028 < 0.05, then H_{a1} is rejected. So the ICT skills of students who learn to use H-PBL are better when compared to the ICT skills of students who learn to use PBL. The differences in the ICT skills of students are generally presented in Figure 3.

The difference between ICT skills in the combination of learning with the H-PBL model and learning with the PBL model, this is because it is influenced by the class that learns with the H-PBL model, there is an online phase so that it can improve the ICT skills of students in education. Apart from differences in ICT skills in general, there are differences in ICT skills based on the indicators suggested by [17], namely (1) Define, (2) Access, (3) Manage, (4) Integrate, (5) Evaluate, (6) Create and Communicate (communicate). The differences in ICT skills based on indicators are presented in Figure 4.
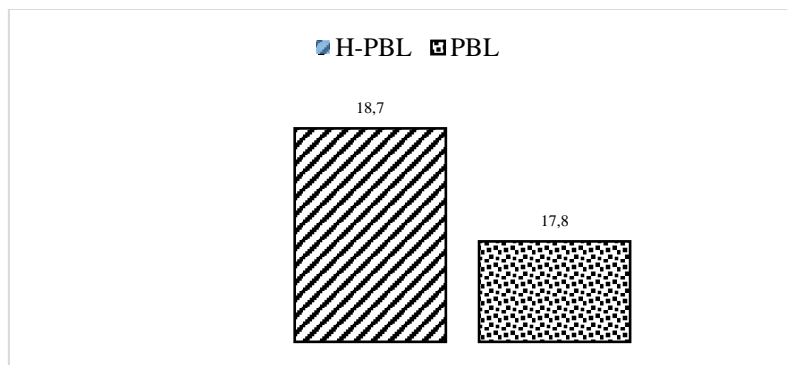

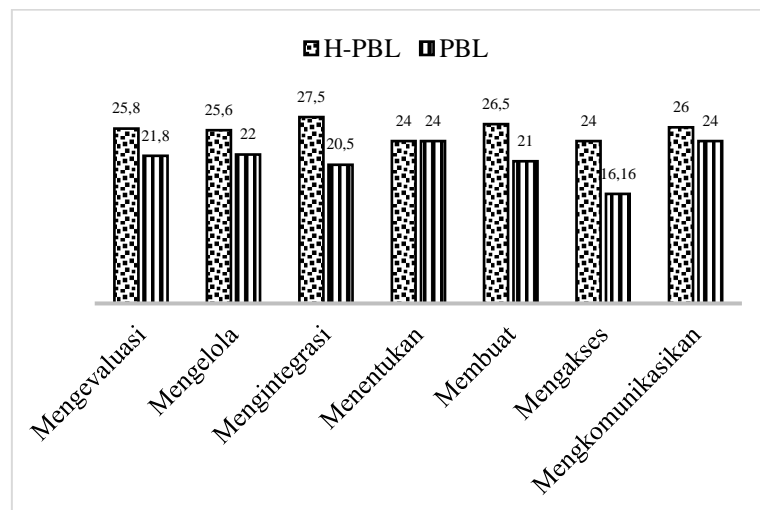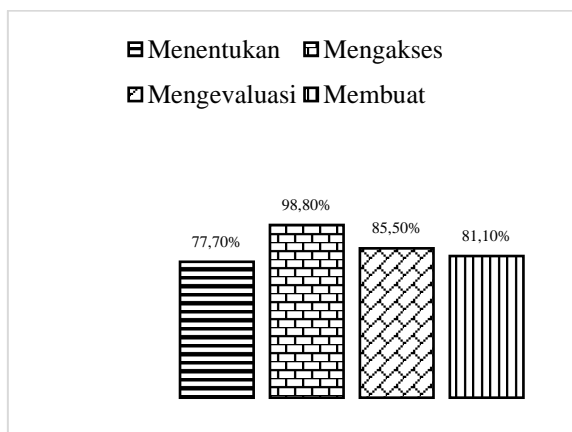**Figure 3.** Students' ICT Skills Results

Figure 4. Students' ICT Skills in H-PBL and PBL Learning

Based on Figure 4, it can be seen that the average score of ICT skills based on the indicators will be presented and the percentage of the observation of ICT skills will be presented after receiving the H-PBL model learning treatment in the experimental class in Figure 5. Judging from the results of questionnaires and observations of ICT skills which refer to the indicators put forward by Katz, it is better to use the H-PBL learning model. Most of the scores for each Katz indicator are better using the H-PBL model than the PBL. This is since the H-PBL model provides more efficient time for the learning process in the classroom, besides that the learning resources and information obtained by students are wider. Besides, students can carry out online discussions, interactions, and find information well. So that students who use the H-PBL model use more technology to get information and understand in-depth concepts.

This study has shown that the H-PBL learning model is very effective in improving students' HOTS abilities and ICT skills. This can be seen from the results of the MANOVA test which states that the results of the Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root procedures on the learning effect all show a significance value of $0.000 < 0.05$. This shows that there is an effect of the dependent variable on the independent variable.

The H-PBL model has provided extensive opportunities for students to study at home independently or with their families before they carry out the learning process in class. The teacher provides assignments or stimuli to students that are carried out online through the schoology application which can provide good initial knowledge. When students are in class they already know what material to study and what concepts need to be understood, besides that students can also ask questions that have not been understood when studying independently at home. So that the learning process in the classroom is more efficient because students in learning activities only carry out investigations related to problems and present the results of the investigation itself. And at the end of learning the teacher provides reinforcement, straightens students' perceptions and draws conclusions from the material that has been studied.

Figure 5. Observation of Students' ICT Skills in H-PBL Learning

The H-PBL phase which affects HOTS and ICT skills is the first phase and the last phase. Because in this phase students build initial abilities according to the concept, in this case, the concept is found by students by looking for answers to the stimulus provided by the teacher. The stimulus is given in the form of videos and animated images that are integrated into the questions. The problems that arise from these questions have been solved by students by utilizing technology to obtain information, so that the students' initial ability to the concept of energy can be developed properly [18].

When students watch learning videos and work on questions given by the teacher online through schoology, this will train students' HOTS and ICT skills. Because in students have used information technology tools to obtain various kinds of information and knowledge. The knowledge obtained is used to solve the problems that arise in the questions in the learning process. Besides that students are free to determine and manage teaching materials, time, place, and various learning resources needed. Students can also carry out online discussions and find out about information or concepts that are not yet understood. Besides, in the last phase, students can do the practice questions in Schoology and send them within a certain period. Thus, they have been able to take advantage of the early stages of the H-PBL learning process which is carried out online by solving problems in practice questions. So that, when students face evaluation questions that are in real face-to-face meetings.

4. Conclusion

The broad opportunities for independent learning that students have in the early stages of learning, the use of media, and animation have been able to encourage students to increase their initial knowledge of the material to be studied. This initial knowledge has been able to increase students' HOTS. In addition, hybrid learning and the use of media and animation in the learning process have been able to improve students' ICT skills

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