JIPF (JURNAL ILMU PENDIDIKAN FISIKA)
p-ISSN: 2477-5959 | e-ISSN: 2477-8451 *Vol. 7 No. 3, September 2022, Page 248-255*

The Effect of Problem Based Learning Applied With Blended Learning on Students' Problem Solving Skills

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Received: April 15th, 2022. Revised: May 15th, 2022. Accepted: May 17th, 2022

Keywords :
PBL Through Blended Learning; Problem Solving; Physics Concepts

ABSTRACT
This research aims to determine the influence of the PBL model applied through blended learning on improving the problem-solving ability of learners on the concept of light topic physics at the junior high school / MTs level. The research method used by the one group pretest posttest design data was obtained through the provision of a problem-solving test consisting of pre-test and post-test. After the pre test, blended learning was conducted 3 times after that post test was carried out. The sample in the study was a class VIII student at integrated MTs in one of Gorontalo's 25 cities. Research and analysis results show the influence of blended learning on problem-solving skills. The ability to solve problems can be seen from the improvement of learners' problem-solving ability on the concept of light. This can be seen from the comparison of the value obtained in the pre-test and post-test analyzed using N-Gain which is as wide as 0.77 with a high interpretation. Other influence indicators can be seen from the pretest average of 37% while the posttest average is 86%. Improvements also occur in all problem solving indicators.

INTRODUCTION

Every student is expected to not only be able to master the concepts learned, but able to apply the concepts that have been understood in solving a problem, especially in the learning of physics. . In fact, learning that is often taken place in the classroom at this time still tends to emphasize mastery of concepts only and often overrides students' ability to solve. problem. As one of the goals in learning physics is the ability to solve problems. This is stated in the curriculum in Indonesia today, one of the competency goals that must be achieved by students in physics learning is problem solving [1].

Problem solving is one of the skills of the 21st century today [2]. Problem solving is an important cognitive activity in the learning process, where these abilities are related to aspects of knowledge, thinking skills, and reasoning skills. It takes a lot of experience to gain the ability to solve problems [3]. By utilizing technology that developed rapidly in the 21st century, especially during Covid-19 which has changed the learning system to online learning, it is considered important in the selection of

strategies to improve the quality of learning. One alternative to the appropriate learning model during the Covid-19 pandemic is blended learning.

Problem-based learning helps students develop thinking skills and problem-solving skills , learn adult roles and become independent learners. The results show that PBL is an effective learning pedagogy that can involve students in active and meaningful learning so that students' understanding becomes deep and Longer retention [4]. Some research also shows the need for development so that problem-based learning is in accordance with learning goals [5]. Some of the development of problem-based learning include Chin & Chia [6], Jones & Wilson [7], Hung [4], and Czabanowska et al [5].

Blended learning is a learning that combines face to face learning and online learning [8]. The blended learning model blends a variety of learning methods and strategies by utilizing virtual technology. Blended learning offers the potential to enhance the teaching and learning process in an educational environment that is more responsive to the lifestyles of contemporary students [9]. Learning activities in the context of blended learning are divided into two parts, namely: synchronous learning and asynchronous learning. Synchronous learning activities that occur simultaneously (simultaneously) between students and teachers even though they are not in the same place [10] [11].

Blended learning during the Covid-19 pandemic, for face-to-face meetings , many video conference applications that can support learning, one of which is zoom meeting. The use of online learning using zoom meetings has the advantage of being able to interact directly between learners and teachers, but has disadvantages including wasteful quotas and less effectiveness. if more than 20 students [12]. Various media combinations can be used for the application of blended learning, including WhatsApp social media. The combination of various learning media can support the application of blended learning with synchronous learning activities and asynchronous learning. Where the use of mobile technology has a large contribution in educational institutions, including the achievement of distance learning goals [13]. Various media can also be used to support learning activities during the Covid-19 pandemic, but the application that is considered very appropriate and accessible is Instant messaging apps like WhatsApp [14].

How important it is to practice various skills during the pandemic is one of the research goals in this article. The skills that are the main focus in this research are problem solving skills that are structured. Problems presented to learners usually consist of: well-structured problems and ill-structured problems [15] [16]. Problems that are discussed in teaching in the classroom, especially science or physics lessons, are usually related to problems structured according to the concepts taught.

METHOD

The methods carried out in this study are using experimental research methods with the design of One Group Pretest-Posttest [17]. The research design scheme can be seen in Figure 1.

Group A	**O_1**	**X**	**O_2**

Fig. 1. *PBL Blended Learning Implementation Design*

Description;
O_1 = Pretest problem solving of the concept of light in the experimental class
O_2 = Posttest problem solving the concept of light in the experimental class
X = Application of Blended Learning to light concepts

After the pre-test, PBL blended learning was conducted 3 times, after which a post test was conducted. The sample in the study was a class VIII student in one of the Integrated MTs in Gorontalo which

numbered 25 people. In this study, the instrument used is a description test totaling 5 questions to measure students' problem-solving abilities. The problem-solving aspects /indicators studied in this study can be measured using pretest and posttest problem solving. The test given is a structured problem solving test that contains five items of description questions that must be solved by students using indicators of problem-solving skills. according to Heller & Heller [18]; namely (a) the stages for focusing physical problems; (b) describe problems in physical concepts; (c) designing solutions according to physical concepts; (d) realize the design of the solution in accordance with the planning or equation planned in the previous indicator; (e) evaluate the results of the answer.

To find out the effect of the application of blended learning on problem-solving skills, an average different test is carried out using a paired t test. In this study, paired t test and one-sample test testing was conducted using the SPSS trial. In addition to conducting different average tests, N-Gain testing is also carried out to see an increase in problem solving capabilities.

RESULTS AND DISCUSSIONS

Describes The results of the test of learners' problem-solving skills individually after applying the PBL model applied by blended learning to light concepts such as Table 1.

Table 1. Problem Solving Ability of Light Concepts Based on Individuals After the Application of PBL applied Through Blended Learning

No Respondent	Pre-Test	Post Test
1	55	91
2	16	74
3	17	79
4	25	88
5	67	95
6	16	93
7	11	88
8	41	91
9	50	95
10	71	88
11	18	75
12	30	76
13	24	76
14	19	87
15	37	93
16	43	85
17	49	88
18	60	84
19	21	84
20	41	89
21	41	87
22	28	76
23	36	88
24	67	95
25	51	79
Average	**37**	**86**

From table 1 above, the problem-solving ability of early learners with an average score of 37 increased to an average of 86 after the implementation of PBL blended learning. In the initial test, 4 respondents (16%) were found to have abilities above 60%. Students' initial test results showed the percentage belonged to the low category. This is in accordance with previous research by Hasan, Mursalin, & Odja [19] which showed the ability of learners' problems including low, which is only 52.58%. In addition to individual problem-solving ability data, there is also the problem-solving ability of light concepts based on indicators.

Table 2. Light Concept Problem solving Capabilities Based on Indicators After Blended Learning Application

Indicators	Pre-test	Post-test
Focus of Physics Problems	78	100
Physical Overview	5,9	60
Planning a Solution to a Physics Problem	61	100
Executing the Plan	33.4	89
Evaluating Problem Solving Physically	32.8	88
Average	**37**	**86**

Table 2 shows that for pre-test activities for problem focus indicators and planning, the ability of learners is above 60%. Indicators give a physical picture, planning and evaluating with the percentage below. The post test results of two indicators that have a high percentage in the pre-test reached a percentage of 100%, while the other three indicators that were initially below experienced a high increase. From table 2, problem focus indicators in both pre-test and post-test show high results, these results are in line with previous research by Hasan, Mursalin, & Odja [19] where the average indicator of the focus of physical problems is 72.50%. The results of Ujulu, Mursalin, Umar, & Odja [20] are also the same for subjects who have high ability and are on problem-solving skills have a high score for indicators focus on physics problems. Likewise for the lowest problem-solving indicator, namely the picture physically where students are less able to interpret the amount of physics both in form of a picture or diagram.

PBL learning with blended learning applications combines face-to-face learning and online learning. Face-to-face during the Covid-19 period is carried out on a limited basis followed by face-to-face with face-to-face using the video conference application, namely zoom meeting. For online meetings instead of face-to-face, teaching is done through utilizing social media in submissions and discussions related to learning. With the help of WhatsApp social media, students can easily discuss through text messages and voice messages in groups formed at the beginning of learning.

To determine the effect of the PBL model implemented with blended learning on problem solving skills, the mean difference test was carried out. Testing is done in two ways, namely Paired Samples Test and One-Sample Test. For the Paired Samples Test the data used are pre-test and post-test score data, to test whether there is a difference in problem-solving skill scores before and after the implementation of the PBL model with the implementation of blended learning, the results are shown in Table 3.

Table 3. Paired t-test results between average pre-test scores and average post-test scores of problem solving skills

No	Data	Average Test (t)	Df	p(2-tailed)	Information
1	Group experiment	-15.280	24.00	< .0000	Ho is rejected

Table 3 shows the significance value of paired t-test results, p (2-tailed) problem-solving skills in the experimental group were <0.05 and all were negative. This means that there is a significant difference

(statistically) in problem solving skills before and after learning with the PBL model implemented with blended learning. Problem solving skills after learning with the PBL model implemented with blended are higher than before learning.

PBL model learning with blended learning implementation is done by combining face-to-face meetings with online. Face-to-face can be done directly in class or done through zoom meetings. Teaching follows the syntax of problem-based learning. The first phase of orientation on the problem, the teacher presents a video related to the properties of light. The second stage orients students to learn by dividing students into groups consisting of 4-5 discussion groups followed by the division of Student activity sheet (LKPD) and teaching materials in each. group. LKPD and teaching materials containing errors related to the properties of light in mirrors and lenses in the WhatsApp group for discussion. The problems presented in the video are real (unstructured) problems in the form of video phenomena and experiments related to the concept of the properties of light and the angle of light. the reflecting and the angle of the rays came. While structured problems related to the exercise of the story about the concept of the properties of light and the angle of light coming and the angle of reflecting rays. Structured problems in the form of exercise questions on the nature of light and light angle rays come and reflecting rays are trained to emphasize student mastery at the stages solving : (a) stages to focus the problem; (b) describe problems for the concept of physics; (c) solution design; (d) realize the design of the solution in accordance with the planning or equation planned in the third indicator; (e) evaluate the results of the answers; teachers and learners discuss solving problems. The third stage of the teacher guides students individually or in groups to solve problems either related to phenomena or experiments or problems related to the practice of solving the problem of the properties of light. The fourth stage develops and presents the work of problem solving results. The teacher asked one of the student group representatives to present the results of the group discussion. Presentations can be done directly through class and through zoom meetings, or done through video recordings sent via WA Group. The last stage analyzes and evaluates the problem-solving process. At this stage the teacher ensures that students have mastered the concept of the properties of light and understand the stages of problem solving.

The second meeting discussed the formation of shadows on flat mirrors, concave mirrors and convex mirrors along with problems related to them. The issues discussed include the problem of forming shadows on flat mirrors, analyzing and measuring the focal distance, the distance of the object's shadow and the location of the shadow on the mirror. concave and convex both through experimental activities and approaches to mathematical equations. The order of teaching is as in the first meeting with more attention to the student who at the first meeting whose understanding towards problem solving is low. Teachers also provide opportunities for students to repeat the stages of problem solving through the video provided. The obstacles experienced by some students are constrained in providing a physical picture on the problem of applying mathematical equations in concave and convex mirrors. By guiding the teacher to the when syntax, students gradually understand the steps of applying mathematical equations in concave and convex mirror problems.

The third meeting is related to the concept of shadow formation in concave and convex lenses and the application of its time. The order of teaching for meeting three as in meeting one and meeting two. At the meeting of the three most students have known and understood the steps of solving the problem. Constraints on the meeting of two mastery and application of mathematic equations are no longer experienced by students at meeting three.

Classically solving student problems after the implementation of PBL model learning implemented through blended learning increased significantly. Based on the results of the data analysis obtained there is a significant influence of the PBL model applied through blended learning on the problem-solving ability indicated by the value of t = -15,280 with The significance value is 0.000. The results of the comparison of the value obtained in the pre-test and post-test were analyzed also using N-Gain, obtained by 0.77 with a high interpretation. Other influence indicators can be seen from the pretest average of 37% while the posttest average is 86%. Improvement occurs also in all problem solving

indicators. The average results of students' problem-solving abilities can be seen in Figure 2.

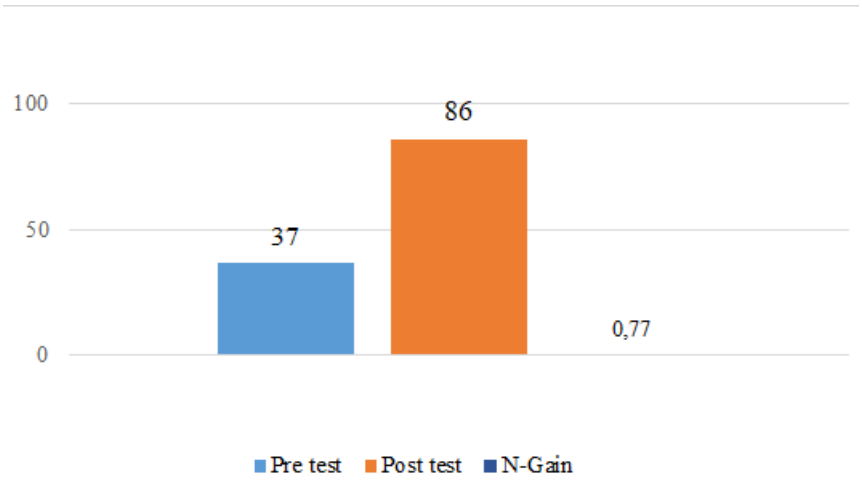

Fig. 2. *Average Results of Pretest, Post Test and N-Gain Problem Solving Ability of Light Concepts*

The influence of blended learning on problem-solving skills can be seen in the improvement of problem-solving skills with a gain value of 0.77. In addition to the increase, it is also seen in the percentage of the post test average value above 80%. The increase occurred due to the implementation of PBL learning implemented by blended learning optimization of various learning media in achieving the goal of learning with indicators of problem solving concept of light.

Utilization of various media can visualize the concept of light as well as how to solve the way to solve problems. In addition, the use of mobile phones that were previously more widely used not for learning activities since Covid-19 turned into one of the important parts of teaching. The use of mobile technology as experienced during the Covid-19 pandemic has a large contribution in educational institutions, including the achievement of distance learning goals [13].

Improved problem-solving ability on the concept of light is also possible because learners can repeat learning at any time, according to the needs of learners. In PBL teaching applied with blended learning carried out is also given the strengthening of learners' self-regulation behavior such as in terms of learning time management and time management. solving the problem. Problem solving requires continuous and repeated practice, through video media sent to social media groups so that students can repeat the stages of problem solving when only without time limits, until students can understand the stages of solving the problem. The use of social media in the teaching of science concepts can help in improving a wide range of skills. One of the studies related to social media by Fatimah, Mursalin, & Odja [21] which found the influence of social media assistance in improving sains communication on the concept of fluid.

CONCLUSION

From the analysis of the data obtained conclusions (1) there is an influence of PBL learning applied through blended learning that is significant to the ability to solve problems in the concept of light; (2) there is an increase in the problem-solving ability of students in one of the MTs in Gorontalo after the implementation of blended learning, with a high improvement category.

ACKNOWLEDGMENTS

Thank you to all those who have helped in completing this research article including the Ministry of Education, Culture, Research and Technology through the 2020 Grant financing, the Leaders of the Faculty of Mathematics and Natural Sciences and Postgraduate UNG and other parties who helped research.

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