Moodle-blended problem solving on student skills in learning optical devices

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Abstract. 21st-century learners are required to have some life skills in order to adapt to the development of science and technology. The ability of learners to skillfully resolve cannot appear by itself but must be mentored and trained through the learning process that involves the application of the concept of Physics in everyday life today. One strategy enhances the ability of problem-solving is through Blended Problem Solving based moodle, which is a combination of Blended Learning and Problem-Solving, as well as supported by media based on Moodle. This research was carried out in the Madrasah Aliyah (Islamic Senior High School) with through quasi-experimental. The taking of samples with a purposive sampling technique, taken two classes from 4 in grade X with a class experiment was students who got the blended problem-solving learning based moodle and control classes that don't get. Improved problem-solving skill is measured by using a subjective matter as much as question 4 refers to the indicator of learning. Results of the study showed a difference of students' problem-solving skill improvement among the class of experiments and control class. Upgrade problem-solving skill class of experiments increases with n-gain 0.71 include categories higher than the class control that increases with n-gain 0.65 that include the category of a middle. Based on the results of a test of the hypothesis with t-test also shows that sig. (0.00) < significance (0.05), meaning that the existence of differences between improvement problem-solving skill of students using blended problem solving based moodle with it is not. This shows that learning with a blended problem solving based on Moodle can be used as alternative problem-solving in learning physics.

1. Introduction
Education in the 21st century is education that must prepare students to solve problems and use technology to benefit the community. This is in line with the desired government through government declared the people of Indonesia to have the ability to live as individuals and citizens who believe, productive, creative, innovative, and effective and able to contribute to the life of society, nation, state, and civilization world. According to Robbinet, the development of students’ skills in the field of science, especially in the field of physics is one key to the success of the ability to adapt to changes in science and enter the world of technology [1].
Physical learning requires that learners have problem-solving skills. Learners need more problem-solving in the real world. Learners need to be conditioned learning conditions such as real work situations in everyday life and other more authentic learning experiences [2]. Because in this century learners should be able to demonstrate various skills such as problem solving, teamwork and the ability to work on their own initiative [3].

The ability to solve physics problems of learners trained through problem-solving because with problem-solving, student can solve every problem in their life. Efforts to design innovative learning using effective strategies for problem-solving skills in learners need to be done [4]. The right tool to create an innovation in the learning process is to take advantage of technological developments.

According to Suarsana, information and communication technology (ICT) has enormous potential as a means to develop skills in the learning process [5]. In improving problem-solving skills it must be adapted to local conditions, and educational objectives to address the constraints of learners and educators in developing ICT [6].

The process of physics learning, especially the concept of optical tools in schools is still informative and provide less real experience in identifying and analyzing problems in learners. Delivery is more often done with presentation slides and exposure to mathematical equations. Learners memorize more concepts without understanding and proving them empirically. So the knowledge gained cannot be applied to solve the problems encountered in everyday life [7].

Utilization of ICT in MAN 1 Sukabumi can be used to support this model with e-learning system. This choice is supported by Stacey & Gerbic which states that Blended Learning as a result of integrating face-to-face learning with ICT-based learning using a web or learning management system (LMS) [8].

According to Turrahma et al. states that learning management system is a system that utilizes the Internet to deliver learning materials that meet the needs of individual learners one of these LMS applications is moodle [9]. Moodle is a name for an application program that can transform a learning medium into a web form [10]. According to Dolgopolov’s learning is not just putting learning material on the web that is then accessed through the computer [11]. Rather it is used to get a superior side that is not owned by media paper or other media. Learning with moodle-based is expected to be the motivation of learners in learning physics and improve problem-solving skills.

Selection of learning models and media as a supporter of learning is based on a strong foundation. This election is also caused by the combination of previous research conducted by Irawan et all namely Blended Learning with problem-solving that is Blended Problem Based Learning [12].

2. Research Method
The research method used is quasi-experiment with two classes as a sample. The experimental class that received blended problem-solving learning was 31 students and control class which did not get the teaching treatments amounted to 32 students. Sampling is done by purposive sample because it takes two classes from 4 classes with the consideration of each class of students is homogeneity. Data problem-solving skill is obtained through the activities of pretest and posttest. The problem-solving test uses four subjective subjects that describe four questions that are tailored to the learning objectives of Optical Materials. Improved problem-solving skills were analyzed using n-gain and statistical analysis of problem-solving test results calculated normality, homogeneity, and then hypothesis testing with a t-test.
3. Result and Discussion

3.1. The result of the problem-solving test

The distribution of students' problem-solving scores can be demonstrated by comparing pre-test and post-test and n-gain average scores on optical device materials. Enhancement of problem-solving skill of learners from the pre-test and post-test result data is shown in Table 1 below.

**Table 1.** Average n-Gain of Experiment Class and control class.

| Class    | n-Gain | Interpretation |
|----------|--------|----------------|
| Experiment | 0.71   | High           |
| Control   | 0.65   | Medium         |

Table 1 shows that the improvement of problem-solving capability through the Blended Problem Solving model on optical device materials for the experimental class included in the high category with an N-Gain value of 0.71, while for control class N-Gain value of 0.65 and included in the category medium.

This shows that there is an improvement in the problem-solving skill of the learner after the application of the Blended Problem Solving model on optical device material. However, the experimental class that gets learning using blended problem-solving based moodle has a better improvement than the control class. This shows that learning in the experimental class is better. In line with that proposed by James et al. that learning using the web provides a better learning experience [13].

The average score of pretest, posttest, and n-gain scores for each aspect of the problem-solving indicator of the learners is shown in Table 2 below.

**Table 2.** Pretest, Posttest, and N-gain for each indicator problem-solving skill

| Indicator KPM | Experiment Class | Control class |
|---------------|------------------|---------------|
|               | n-Gain           | Interpretation| n-Gain       | Interpretation|
| Useful Concept Description | 0.75 High | 0.68 Middle |
| Physical Approach | 0.87 High | 0.66 Middle |
| Specific Physical Approach | 0.64 Middle | 0.63 Middle |
| Mathematical usage | 0.59 Middle | 0.53 Middle |
| Progressions Logical | 0.68 Middle | 0.50 Middle |

Based on the data in Table 2 the improvement of problem-solving skill of the participants in the experimental class or control class on the KPM aspect is a useful concept description and the physics approach has high N-Gain value, whereas in KPM aspect the correct physics approach, the proper use of mathematics and the logical progression has N-Gain value with medium category.

The average score of pretest, posttest, and N-gain for each sub concept of optical tools can be seen in the table below.

**Table 3.** Pretest, Posttest, and N-gain for Each SubConcept of Optical Devices

| Sub concept | Experiment class | Control class |
|-------------|------------------|---------------|
|             | n-Gain           | Interpretation| n-Gain       | Interpretation|

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Eye and Glasses  |  0.71  |  High  |  0.65  |  Middle
Magnifying glass |  0.73  |  High  |  0.66  |  Middle
Microscope       |  0.68  |  Middle|  0.45  |  Middle

Table 3 above shows that there is an increase in the value of problem-solving abilities in the sub-concepts of optical instruments, eyes and eyeglasses, loops and microscopes in both classes, both experimental and control classes. It is seen from each class having N-Gain on each sub concept but with a different interpretation. The N-gain value in the experimental class for the sub-concepts of Eye and glasses is 0.71, Magnifying glass is 0.73 both values are included in the high category. For microscope material of 0.68 included in the medium category. Another case in the control class in the sub-eye chapter and glasses has a value of N-Gain of 0.65, on the loop of 0.66 and on the microscope material of 0.45. The N-Gain value is included in the medium category and each sub-concept has the same increase. This shows blended problem-solving learning to give effect to each sub concept of material, in line with research conducted by Livotov that web-based problem-solving learning can give good effect to student problem-solving skill [14].

3.2. Hypothesis testing

Before performing hypothesis testing, the data must first be tested normality using the normality test to determine the equation of the exact hypothesis with research data. Normality test is done to know the data obtained normal or abnormal distributed, then step done is by chi-square test. Obtained recapitulation of normality test results using chi-squared can be seen in Table 4

| Aspect     | Pre-test |          | Post-test |          |
|------------|----------|----------|-----------|----------|
|            | Experiment class | Control Class | Experiment class | Control Class |
| Statistic  | 972      | 946      | 954       | 924      |
| df         | 31       | 32       | 31        | 32       |
| Sig.       | 0.580    | 0.111    | 0.191     | 0.123    |

Table 4 Test the normality of pretest and posttest data.

Table 4 shows the results of the normality test analysis show the data for the experimental class and control class both pretest and posttest data are normally distributed because of the sig. the overall value is greater with a significance level of 0.05. Therefore, the hypothesis test is done by using paired sample t-test.

Homogeneity test is intended to show that two groups of sample data come from populations having equal variance. Obtained recapitulation of homogeneity test results using can be seen in Table 5

| Aspect    | Pre-test | Post-test |
|-----------|----------|-----------|
| Levene statistic | 0.201    | 3.445     |
| df1       | 1        | 1         |
| df2       | 61       | 61        |
| Sig.      | 0.651    | 0.68      |

Table 5 Homogeneity pre-test and post-test for experiment and control classes.
Table 5 shows that sig. is greater than the 0.05 significance level, meaning that there is no difference in variance in either sample or it can be said that the experimental class and control class are homogeneity.

The result of data analysis is normal and homogeneous distribution hence hypothesis test is done by using paired sample t-test with significance level 5%. The results of t-test analysis can be seen in the following table 6.

| Statistic | Pre-test | Post-test |
|-----------|----------|-----------|
| T         | 4.384    | 5.623     |
| df        | 61       | 61        |
| Sig. (2-tailed) | .054 | .000     |

Based on the t-test result listed in table 6 above, pretest data shows the Sig value 0.054 Which value is greater than the significance level of 0.05, meaning there is no difference in the students’ initial ability between the experimental class and the control class. The posttest data shows the Sig value 0.000 which value is smaller than significance level of 0.05, it means there is a difference of end ability of student between experiment class and control class.

This shows that there is a difference in the ability of problem-solving among students who get Blended Problem Solving learning on optical instrument materials with those not. This is in accordance with the results of research conducted by Avci et al that the use of appropriate technology will support the success of learning in improving the problem-solving skills of learners in physics lessons [15]. This result is also in line with the research conducted by Przybilla et al. [16] whose results suggest that the application of the Blended-Problem solving model through moodle applications can improve the ability to think creatively. Problem-solving ability, critical thinking ability, and creative thinking ability are high-order thinking skills.

4. Conclusion
The use of Blood problem-solving model based on Moodle in Optical devices can improve students’ problem-solving skill. This happens because of continuity between the blended problem-solving model stages in the learning process with the stages of problem-solving skill that must be possessed by the students.

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