Effectiveness of Physics Learning Tools using Blended Learning Model with Video Assistance on Momentum and Impulse Materials to Improve Problem Solving Ability of Students

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Abstract: This study aims to determine the effectiveness of physics learning tools using blended learning model with video assistance on momentum and impulse materials to improve problem solving ability of students. The learning tools were developed using a 4D model which includes the stages of define, design, develop, and disseminate. Learning tools developed in the form of syllabus, lesson plans, student worksheets, learning videos, and problem solving ability instruments in the form of descriptions with a total of 5 questions. The research data was obtained from the results of a limited trial in the tenth grade MIPA 4 SMAN 1 Mataram with a total of 33 people. The data obtained from the next study were tested for the value of n-gain to find out the improvement in problem solving abilities. The results showed that the overall value of n-gain was 0.66 in the medium category. In addition, the n-gain analysis of each problem solving indicator shows that the indicators of recognizing problems and planning strategies have increased with the n-gain value being in the medium category, while the indicator implementing strategies and evaluating solutions has increased with the n-gain value being in the high category. These results indicate that the physics learning tools using blended learning model with video assistance on momentum and impulse materials is effective to improve problem solving ability of students.

Keywords: Blended learning model; Learning tools; Problem solving ability.

Introduction

Learning is all events that can have a direct influence on the occurrence of learning in humans. Thus, in the context of classroom learning, the teacher or lecturer is one of them, not the only one. In another sense, learning is defined as an effort to provide stimulation, guidance, direction, and encouragement, all efforts are aimed at achieving goals (Hanafi et al, 2018).

Physics is one part of Natural Sciences, which is a science that studies symptoms, events or natural phenomena and reveals all the secrets and laws of the universe (Doyan et al, 2022). Physics as a product is the result of scientific activities carried out in the form of concepts, principles, theories, and the laws of physics itself. Then physics as a process is in understanding various information, especially physics obtained through observations, measurements, and publications. In addition, physics as an attitude means that as a scientist in studying something, you must have a disciplined attitude and have a high curiosity in order to produce quality physics products (Gunawan, 2017).

Physics is a science that is considered difficult and boring by most students because it is focused on

memorizing formulas, resulting in a lack of ability to solve problems (Saharsa et al, 2018; Annam et al, 2020; Azizah et al, 2018). The problem that often occurs in the field is the lack of students' ability to apply the concepts that have been learned, so that it affects problem-solving abilities in answering questions (Hardiyansyah et al, 2019; Doyan et al, 2020; Susilawati et al, 2022). One of the causes of the low solving ability of students is that the learning process is still teacher-centered, so that students are only objects in learning activities and are not given the opportunity to find out the truth of the physics concepts they learn (Nurjannah et al, 2021; Susilawati et al, 2022). In addition, the limited learning space and time during this pandemic condition, causes students to not be given optimal material, this is because teachers only give assignments from home, do practice questions as a substitute for learning at school and demand students to be more active. independent learning (Rahmawati et al, 2020; Susilawati et al, 2021).

Based on the results of interviews conducted with teachers and students at SMA Negeri 1 Mataram, students assume that during the current pandemic conditions, teachers often provide practice questions which result in students having limited ability to answer questions, so that students' problem solving abilities are low. The learning model that is often used in schools is conventional learning with lecture and discussion methods, this is not in accordance with the current pandemic conditions. In working on physics problems given by the teacher, students more often directly use mathematical equations without analyzing, guessing the formula used and memorizing examples of questions that have been done to work on other questions. Students have difficulty when dealing with complex problems. In addition, the cause of the low problem-solving ability of students is that teachers as educators still tend to dominate in the learning process, so that students are only objects in learning activities and are not given the opportunity to find out the truth of the physics concepts they learn.

The lack of problem solving skills of students requires teaching materials and the use of appropriate models (Kartini et al, 2019; Khasanah et al, 2022). To overcome these problems, the teacher must change the learning model that is carried out so that students are interested and have the enthusiasm to keep learning even in a pandemic condition. One of the learning models that are suitable for current pandemic conditions is the blended learning (Putri et al, 2022; Rahmana et al, 2021). Blended learning is mixing between online and face-to-face meetings in an integrated learning activity (Rahmana et al, 2021). The purpose of developing blended learning is to combine the best characteristics of classroom (face-to-face) and online learning to increase active independent learning by students and reduce face-to-face time in class. In line with blended learning that was developed by previous researchers, there are

several research results on blended learning, including the results of research conducted by (Doyan et al, 2022), with the implementation of blended learning using online and face-to-face design that student learning outcomes have increased significantly indicated by a value above the completeness criteria. Similarly, research conducted by (Sudiarta et al, 2016) that blended learning greatly influences students' problem solving abilities compared to conventional learning and gets a positive response to students' problem solving abilities. Therefore, problem solving skills are important to support the achievement of physics learning objectives.

Teaching physics will be more effective if the learning can train and develop thinking skills possessed by students so that they are able to communicate, interact, and cooperate. Physics learning in schools in general uses tools to facilitate the delivery of material, one of the technology-based media that can lead to interaction and reciprocity that develops in the world of education today, namely learning videos (Yani et al, 2017). The use of videos in physics learning will greatly assist students in understanding abstract and complex concepts. The success of a learning is also supported by the use of appropriate media, one of which is video (Rahmana et al, 2021). Doyan et al (2022) stated that the delivery of learning using video will make students interested so that it can arouse curiosity and new interests, generate motivation and stimulation of learning activities and bring a good psychological influence on students.

In line with this, it is necessary to innovate and creative teaching efforts that lead to the achievement of learning objectives. Success in the learning process is strongly influenced by the learning tools used, for that it is necessary to develop learning tools. Based on this explanation, the researcher intends to carry out a study that aims to determine the effectiveness of blended learning model learning tools with video assistance on momentum and impulse materials to improve problem solving ability of students.

Method

This study aims to determine effectiveness of physics learning tools using blended learning model with video assistance on momentum and impulse materials to improve problem solving ability of students. The learning tools were developed using a 4D model which includes the stages of define, design, develop, and disseminate (Sugiyono, 2017). The tools developed are syllabus, lesson plans, worksheets, learning videos, and the instrument improves problem-solving skills in the form of a description with a total of 5 items. The research data obtained from the results of a limited trial in class X MIPA 4 SMAN 1 Mataram which amounted to 33 people. The data obtained from further research was tested for the value of n-gain to determine

the increase in ability problem solving N-gain analysis was carried out using equation 1 which consists of three criteria, namely low criteria (0.00<g<0.30), medium (0.30≤g<0.70), and high (0.70≤g≤1.00) (Doyan et al, 2020). Based on these criteria, the learning device developed is declared effective if an assessment result of 0.30 is obtained in the medium category.

$$g = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}} \qquad (1)$$

Where S_{post} is posttest score, S_{pre} is pretest score.

Result and Discussion

This study aims to determine the effectiveness of physics learning tools using blended learning model with video assistance on momentum and impulse materials to improve problem solving ability of students. The effectiveness of learning stools is seen from the improvement of students' problem solving abilities based on the results of n-gain conducted through pretest and posttest in class. The problem-solving ability test instrument consists of 5 questions in the form of a description which is done in 60 minutes. The pretest and posttest data and the value of n-gain. The value of n-gain is shown in Table 1.

Table 1. The N-Gain Value of the Students' Problem-Solving Ability

Pretest	Posttest	N-gain	Category
18.52	72.27	0.66	Medium

Table 1 shows the average score for the pretest 18.52 with the highest score of 41 and the lowest score of 5. Meanwhile, the average score for posttest is 72.27 with the highest score is 80 and the lowest score is 40. Based on the results of the *n-gain*, table 1 shows the *n-gain* of 0.66 in the medium category. The acquisition of pretest and posttest scores for each tenth grade MIPA 4 students can be seen in Figure 1.
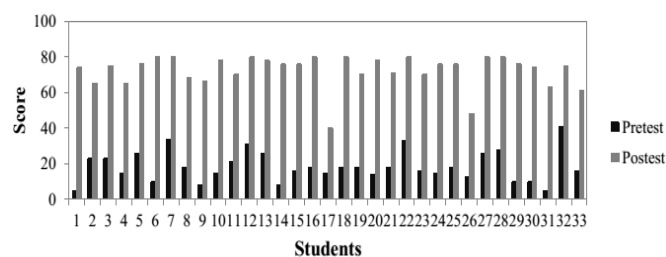
Figure 1. Pretest and posttest values from students

The results of the n-gain test for each problem-solving ability indicator can be seen in Table 2.

Table 2. The N-Gain Value of Each Indicator of Problem-Solving Ability

Indicator	Pre test	Post test	N-Gain	Category
Recognizing problems	18.55	51.76	0.41	Medium
Planning strategies	6.79	46.67	0.43	Medium
Implementing strategies	40.97	96.43	0.94	High
Evaluating solutions	9.58	93.73	0.93	High

Table 2 show that the indicator of problem-solving ability which consists of recognizing problems, planning strategies, implementing strategies and evaluating solutions shows the n-gain value in the medium category. Based on these results, it can be seen that there is an increase in students' problem solving abilities. Furthermore, from 33 students it was found that the highest increase in problem solving ability was experienced by 14 people, then 18 people in the medium category and 1 person in the low category. The details of the data can be seen in Table 3.

Table 3. Percentage of N-Gain Scores from Students

N-gain Score	Category	Number of Students	Percentage
0.70≤g<1.00	High	18	55%
0.30≤g<0.70	Medium	14	42%
0.0<g<0.30	Low	1	3%

Table 3 shows the percentage increase in problem solving skills with the high category of 55%, the medium category of 42% and the low category of 3%. Based on these percentages, it can be said that the developed learning tools can improve students' problem solving abilities even though the increase is not too significant seen from the n-gain which is in the medium category. This is due to the limited time to do the pretest and posttest, so there are some students who collect the results of the pretest and posttest past the specified time limit.

In addition, from the four problem-solving ability indicators used in this study, it can be seen that the indicators of recognizing problems and planning strategies are indicators of problem-solving abilities which have n-gains of 0.41 and 0.43. Meanwhile, indicators of implementing strategies and evaluating solutions have the highest increase in n-gain of 0.94 and 0.93 in the high category. The increase in indicators of recognizing problems can be seen from the ability of students to write down facts or write down quantities based on the illustrations and pictures given to the questions correctly. Furthermore, the increase in indicators for planning strategies can be seen from the ability of students to write down the quantities asked in the questions. While the indicators of implementing strategies and evaluating solutions can be seen from the

increase in the ability of students to determine the equations used, calculate to the end with the right answer. In addition, students can explain with the right concepts about the problems given. So, it can be said that the device developed is effective in improving the problem solving ability of students. This is also supported by research conducted by Sudiarta et al (2016) and Doyan et al (2022) which states that the development of blended learning can improve problem solving abilities of students.

Conclusion

Physics learning tools using blended learning model with video assistance on momentum and impulse materials to improve problem solving ability of students have been successfully developed. The results showed that the overall n-gain was 0.66 in the medium category. In addition, the n-gain each problem-solving indicator shows that the indicators of recognizing problems and planning strategies have increased with the n-gain being in the medium category, while the indicator implementing strategies and evaluating solutions has increased with the n-gain being in the high category. These results indicate that the physics learning tools using blended learning model with video assistance on momentum and impulse materials is effective to improve problem solving ability of students.

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