The Effect of Problem-Based Learning Model Assisted by Contextual Videos on Students' Learning Outcomes in The Subject of Sound Waves

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Received: 23 June 2023; **Accepted**: 30 November 2023; **Published**: 13 December 2023
DOI: https://dx.doi.org/10.29303/jpft.v9i2.5269

Abstract *- This study aims to determine the effect of problem-based learning models assisted by contextual videos on student learning outcomes in sound wave material. The type of research used is a quasi-experimental design with nonequivalent control group design. The population in this study were all students of class XI MIA SMAN 4 Mataram. Sampling used a purposive sampling technique, so that XI MIA 3 students were obtained as a control group using a conventional learning model and XI MIA 4 as an experimental group using a problem-based learning model assisted by contextual video. The instrument used is an observation sheet for affective and psychomotor assessment, a multiple choice test that refers to the cognitive abilities of students from C1 to C6 as many as 18 items taking into account the validity, reliability, discriminatory power and difficulty level of the questions. Study result data were analyzed using parametric statistics, namely t-test polled variance with a significant level of 5% and obtained t_count of 3.77 and t_table of 1.99. According to the hypothesis testing criteria, if t_count>t_table, then Ho is rejected and Ha is accepted, so it can be concluded that the contextual video-assisted problem-based learning model influences student learning outcomes in sound wave material.*

Keywords: *Problem-based Learning; Contextual Video; Learning Outcomes.*

INTRODUCTION

The development of the 21st century is marked by rapid advancements in science, technology, and information that influence nearly every aspect of life, including education. Education is expected to produce graduates with quality and competitiveness to meet the demands of the skills required in the 21st century. As Dewantara (2021) stated, education in the 21st century is expected to prepare learners with the skills of learning and innovation, skills in using and utilizing technology and information media, the ability to work and survive using life skills.

Education in the 21st century is expected to equip learners with various skills. These skills are essential for learners to achieve the expected learning outcomes. Priyanto (2019) emphasized that 21st-century skills are necessary to face the challenges in the global society of the 21st century. The 21st-century skills framework includes four skills needed by learners in the 21st century, known as the 4C competencies: Creativity Thinking and Innovation, Critical Thinking and Problem Solving, Communication, and Collaboration (Dewantara, 2021). Achieving these 21st-century skills is accomplished through curriculum updates, such as the implementation of the K-13 curriculum. One of the subjects where K-13 is applied is physics.

Natural Sciences (IPA), including physics, is one of the branches of science. Physics is the science that studies the nature and phenomena of the universe, as well as all the interactions that occur within it. Gunawan et al. (2015) stated that physics focuses on the study of matter, energy, and the relationships between them. Active student engagement in the learning process is essential. However, in reality, physics education in schools still tends to be teacher-centered. Teacher-centered learning cannot equip students to solve everyday life problems.

Based on observations and interviews conducted at SMAN 4 Mataram, the learning outcomes of class XI students are still not optimal. Many students have not reached the minimum passing grade set by the school, which is 78. This can be seen from the relatively low average scores on the physics midterm exams. Furthermore, the teaching and learning process in class XI was found to be predominantly teacher-centered. In interviews with some class XI students at SMAN 4 Mataram, physics is considered a difficult and boring subject because of the complex formulas. This is in line with the opinion of Setyowati & Subali (2011) that physics is perceived as difficult by students because most of them are unable to connect the material they learn with practical knowledge. Students tend to memorize rather than analyze problems, so when they are faced with problems that require analysis, they struggle to solve them. This lack of interest in physics results in low learning outcomes.

To address these issues, it is necessary to implement a suitable teaching model that can enhance the activity and learning outcomes of physics students. One alternative teaching model that can be applied is problem-based learning (PBL). Ngalimun (2017) defines PBL as a learning model that involves students in solving problems through scientific methods, allowing students to learn knowledge related to the problem and develop problem-solving skills. In the PBL model, real-life (contextual) problems are presented, making physics relevant to concrete phenomena or issues.

Learning activities using the PBL model require the use of teaching media. The use of teaching media makes it easier for teachers to deliver material and for students to understand it, thereby increasing students' interest in learning physics (Sudjana & Rivai, 2013). One such medium is video, which is used during the delivery of teaching materials. According to Arsyad (2013), video can depict moving objects with accompanying sounds. Video's ability to depict dynamic images and sounds adds to its appeal. It can also illustrate objects and events as they truly are. According to Trianto (2015), video should be used to engage students fully, helping them discover the material being taught and connect it to real-life situations, encouraging them to apply it in their daily lives. Learning using videos can make physics more engaging, interactive, and communicative, emphasizing active knowledge formation and focusing students' attention during the learning process (Resta et al., 2013). The instructional video used in this context is a contextual video.

Contextual video is a teaching video that connects the material to the real-life experiences of students, linking the learning material to natural phenomena in students' daily lives. Contextual learning is motivated by the low quality of learning outputs, characterized by the inability of most students to connect what they have learned in school with the application of knowledge in their lives (Depdiknas, 2008). Contextual instructional videos are expected to meet the demands of the 21st century, as teachers are required to use teaching media. Contextual videos can train students to identify natural phenomena in their daily lives, thus increasing their interest, attitude, motivation, and learning styles, ultimately improving learning outcomes. This is in line with research conducted by Andriani et al.

(2021), which found that the use of contextual video media in experimental groupes had a greater impact on improving student grades from pretest to posttest. It can be concluded that the use of contextual video can improve learning outcomes. Furthermore, research by Hamdanillah et al. (2017) showed that the use of video teaching media significantly improved student learning outcomes, as students were actively engaged in the learning process compared to the control group, which relied on conventional teaching methods centered around the teacher. Therefore, the use of video teaching media can help students understand the material.

Based on the above discussion, the researcher is interested in implementing problem-based learning aided by contextual video to improve the learning outcomes of students in the subject of sound waves.

RESEARCH METHODS

This research is a quasi-experimental study with a Nonequivalent Control Group Design. The study population consists of all students in the 11th grade MIA (Natural Sciences) class at SMAN 4 Mataram. The sampling technique used is purposive sampling, resulting in XI MIA 3 as the control group, which uses conventional teaching methods, and XI MIA 4 as the experimental group, which uses problem-based learning aided by contextual video.

The variables in this study include the independent variable, which is the problem-based learning model aided by contextual video, and the dependent variable, which is the learning outcomes in the subject of sound waves.

Data collection in this study involves performance tests, including observation sheets used to measure the affective and psychomotor learning outcomes of physics students, and objective tests consisting of 18 multiple-choice questions to measure cognitive learning outcomes. The selection of these tests followed criteria such as instrument validity, reliability, difficulty level, and discrimination index. Tests are conducted twice, including a pretest and a posttest. The pretest is administered before the learning activities to assess the students' initial understanding of the subject matter. Therefore, homogeneity is tested on the pretest data using Variance (F-test) and normality using the Chi-Square test. On the other hand, the posttest is conducted after the learning activities to evaluate the students' learning outcomes. Data analysis for the posttest includes normality (Chi-Square test), homogeneity (Variance test), and hypothesis testing using the t-test with a significance level of 0.05. The hypothesis test is used to determine the influence of the problem-based learning model aided by contextual video on the learning outcomes of students in the subject of sound waves.

RESULTS AND DISCUSSION

The research results include a description of student learning outcomes data, data from the pretest and posttest, and hypothesis testing. The learning outcomes data are described in terms of cognitive, affective, and psychomotor domains.

For the cognitive domain, the data on student learning outcomes in this study are obtained from the pretest and posttest results. Meanwhile, data on learning outcomes in the affective and psychomotor domains are obtained from observations and serve as supporting data for the research in the experimental group.

The data from the pretest and posttest regarding physics learning outcomes for both the experimental and control groups can be seen in Table 1.

Table 1. Learning Outcome Pre-Test Results

	Pre-Test	
Component	Experimental Group	Control Group
Total students	33	30
Highest Score	67	56
Lowest Score	23	23
Average Score	37,72	40,46
Normality Test	Normal	
Homogeneity Test	Homogeneous	

The data from the initial test results in Table 1 show that the average score of the experimental group is lower than that of the control group, which is 37.72 compared to 40.46. The average scores of both classes are still categorized as low because they are below the minimum passing grade (KKM). Based on the results of homogeneity and normality tests, both classes are homogeneous and normal. This means that both classes had the same initial abilities before the treatment. Next, the results of the final test scores for the learning outcomes of the experimental group and the control group can be seen in Table 2.

Table 2. Learning Outcome Post-Test Result

	Post-Test	
Component	Experimental Group	Control Group
Total students	33	30
Highest Score	95	84
Lowest Score	51	29
Average Score	76,78	65,60
Normality Test	Normal	
Homogeneity Test	Homogeneous	
	$t_{count} > t_{table}$, Ho rejected and Ha accepted	

The data from the final test results in Table 2 show that the average score of the experimental group is higher than that of the control group, which is 76.78 compared to 65.60. This indicates that both classes have shown improvement. However, the increase in the average score of the experimental group is higher than that of the control group. The experimental group experienced an increase of 39.06, while the control group had an increase of 25.14. This is marked by the rise in the average scores of students after the treatment. The average score of the experimental group, which was treated with the problem-based learning model aided by contextual video, is higher than that of the control group, which used the conventional model.

The final test results were then subjected to a normality test using the Chi-Square formula, and it was found that the data for both classes were normally distributed. Additionally, the homogeneity test using the F-test showed that both classes were homogenous. Therefore, parametric statistics were used, namely the t-test with a significance level of 0.05. The hypothesis test using the t-test yielded a t-value greater than the critical t-value, which is 3.77 > 1.99. The results of the hypothesis test indicate that there is an influence of providing the problem-based learning model aided by contextual video on the learning outcomes of students in the subject of sound waves. This research aligns with previous studies, such as Wulandari & Surjono (2013), which stated that there is a significant difference in learning outcomes between students who learn using problem-based learning and those who learn using demonstrations. Furthermore, the application of the problem-based learning model aided by contextual video can also encourage students to be more active in learning and enhance collaboration in the learning process. This is consistent with the findings of Azmi et al. (2016), which demonstrated that problem-based learning models have an impact on student learning outcomes. The improvement in student learning outcomes, in the form of a graph, is shown in Figure 1.

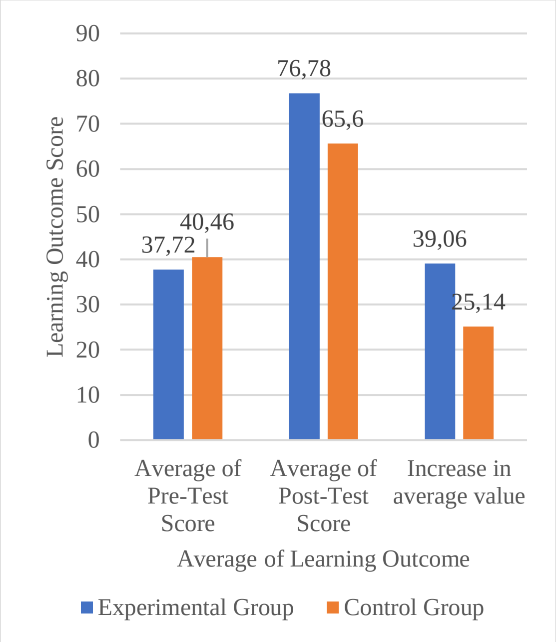

Figure 1. Comparison of the Average Learning Outcome Improvement

Problem-based learning can also cultivate the creativity of students, both individually and in groups because almost every step of the activity demands the students' active participation. By applying problem-based learning, students can improve their problem-solving abilities. This aligns with Riyanto (2009), who stated that problem-based learning models were developed to enhance students' problem-solving abilities. Furthermore, this aligns with the research of Munandar et al. (2018), which indicated that problem-based learning models have an impact on the cognitive learning outcomes of physics students, ranging from Bloom's Taxonomy levels C1 to C6 (remembering, understanding, applying, analyzing, evaluating, and creating).

The learning activities in the experimental group begin by presenting students with a new situation, which involves asking them to pay attention to a problem through a video shown by the researcher. Then, they are required to formulate hypotheses regarding the material on sound waves based on the video. These hypotheses are written in the Student Activity Sheets (LKPD), which will be used for practical activities. The Problem-Based Learning (PBL) model is facilitated by presenting a contextual video related to the material on sound waves in the first phase of the PBL syntax, which is orienting students to the problem. This approach ensures that students are focused right from the beginning of the learning activity. The use of contextual video is also applied in the third phase of the PBL model, which involves guiding individual or group investigations. The application of contextual video in this phase is suitable because students conduct investigations or experiments to find answers to the problems presented. The use of the problem-based learning model aided by contextual video stimulates the curiosity of students, which is followed by conducting experiments to prove what they have learned. This process leads to students understanding, knowing, and accepting the theory they have learned, resulting in improved learning outcomes. According to Apriani et al. (2016), problem-based learning models provide students with the opportunity to be more active in learning, which subsequently affects their learning outcomes, especially when solving problems provided in the learning process through practical activities. Furthermore, this research is in line with Jauhari et al. (2016), who stated that the problem-based learning model has the ability to enhance higher cognitive skills based on the improvement in learning outcomes compared to the control group, which received conventional teaching.

In this research, contextual video media is part of the learning process, making it easier for students to remember, stimulating critical thinking processes to understand the problem, and increasing students' learning activities through the videos presented by the teacher. In line with this, Muliani & Wibawa (2019) stated that video media is utilized to stimulate the learning process to improve students' critical thinking skills, as well as their interest and motivation through video presentations. Moreover, Purwanto (2013) mentioned that videos are one of the supports for enhancing student activity. Additionally, Wulan (2022) also stated that learning aided by video media is used to obtain information that can be extracted from real-life problems. Partayasa et al. (2020) revealed that video media as a source of learning can improve concept comprehension, student engagement, and learning outcomes. Thus, contextual video media becomes an alternative source of learning that can capture students' attention, prevent boredom, and train critical thinking skills to solve problems. This aligns with the research of Noviyanto et al. (2015), which found that the use of video media in the experimental group had a greater impact on improving students' scores from pre-test to post-test. Furthermore, this is consistent with the research of Yolanda et al. (2019), which indicated that the use of contextual video had a significant influence on the experimental group. This research does not focus solely on the cognitive domain but also takes into account the assessment of the affective and psychomotor domains.

The learning outcomes in the affective domain for the experimental group and the control group are different. The average observation results for the affective domain in the experimental group are higher than in the control group. This is because the experimental group uses the problem-based learning model aided by contextual video with a practical method that motivates students to take more responsibility for what the teacher assigns in the practical activities. Students in the experimental group are required to be active in the learning process compared to the control group, where learning is teacher-centered, leading to less enthusiasm for learning. The curiosity of students in the experimental group is greater than in the control group, and using the problem-based learning model aided by contextual video with practical methods makes students in the experimental group more amazed by the greatness of God because they can see and prove for themselves what they have learned. According to Supardi (2015), the affective domain of the learning process emphasizes the personality of students, their attitudes, behavior, and respect for others during the learning process. Based on the observations made by the observer during the learning activities, it can be concluded that the learning outcomes in physics are better in the experimental group than in the control group in the affective domain.

The learning outcomes in the psychomotor domain focus on providing students with experiences to be skilled in doing something using the resources available. The psychomotor learning outcomes in the experimental group are higher than in the control group, even though both classes conducted presentations. The presentations made by students in the experimental group were better than those in the control group. This is because the experimental group applied the practical method, where students conducted experiments and proved for themselves what they had learned, resulting in a greater sense of curiosity. On the other hand, students in the control group were less enthusiastic about learning because they did not engage in practical activities and, therefore, did not have the opportunity to prove for themselves what they were learning. Qosim et al. (2015) stated that the experimental group treated with the problem-based learning model aided by cartoon videos had better psychomotor skills than the control group.

CONCLUSION

Based on the research findings and discussions, it can be concluded that there is an effect of the problem-based learning model aided by contextual video on students' learning outcomes in the topic of sound waves.

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