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THE EFFECT OF USING INTERACTIVE LEARNING VIDEOS ON MOTIVATION AND PHYSICS LEARNING OUTCOMES

Haridanti[1], Linda Sekar Utami[2], Johri Sabaryati[3]
[1,2,3]Program Studi Pendidikan Fisika, Universitas Muhammadiyah Mataram, Indonesia
hardianticmc269@gmail.com

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ABSTRACT

The use of story-based instructional video represents a crucial aspect of physics education because students often encounter difficulties in understanding abstract concepts, leading to low conceptual comprehension and suboptimal learning outcomes. This issue necessitates further investigation into the effectiveness of integrating storytelling elements within video-based learning to enhance students' conceptual understanding. This study aims to examine the effect of story-based learning videos on students' conceptual understanding in physics. The research employed a quantitative approach using a quasi-experimental method with a pretest–posttest control group design. Data were collected through conceptual understanding tests, supported by observation and documentation. The obtained data were analyzed using descriptive statistics and inferential analysis, including the t-test and N-gain calculation. The findings reveal that students taught using story-based instructional videos demonstrated a significant improvement in conceptual understanding, as evidenced by an increase in the mean score from 63.20 to 84.10 and an N-gain value of 0.72, categorized as high, along with a statistically significant difference between the experimental and control groups. These results indicate that the integration of storytelling in video-based learning effectively enhances students' comprehension of abstract physics concepts and promotes more meaningful learning experiences. This study contributes significantly to the advancement of physics education at both national and international levels by providing an innovative, technology-enhanced pedagogical approach that supports interactive and engaging learning environments. Furthermore, the findings are expected to serve as a valuable reference for future research, particularly in the development of multimedia-based instructional strategies and the exploration of their long-term impact on conceptual understanding and higher-order thinking skills.

Keywords: Interactive Learning Videos, Learning Motivation, Physics Learning Outcomes, Physics Education, Instructional Media.

INTRODUCTION

Physics learning plays a crucial role in fostering students' scientific literacy, logical reasoning, and problem-solving skills. However, at both national and international levels, numerous studies and educational reports indicate that students frequently perceive physics as a difficult and abstract subject, which adversely affects their motivation and learning outcomes. This issue is particularly evident in secondary education, where teacher-centered instruction and the limited use of engaging instructional media remain prevalent, resulting in passive learning behaviors and suboptimal academic performance. Moreover, prior research highlights that

***Correspondence Author**
Haridanti

the lack of appropriate instructional media significantly contributes to students' difficulties in comprehending abstract physics concepts (Author, Year).

Despite the rapid advancement of educational technology, the integration of interactive video-based learning in physics classrooms is still relatively limited, making this issue both urgent and highly relevant. This condition underscores the need for innovative instructional approaches that are capable of transforming passive learning environments into more engaging and student-centered experiences, particularly in the context of physics education.

From a critical perspective, students' low motivation and learning outcomes are not solely determined by cognitive ability but are also shaped by the design of instructional strategies and media. Instructional practices that fail to consider how students process information may hinder the development of meaningful understanding, especially when dealing with abstract scientific concepts.

Referring to the Cognitive Theory of Multimedia Learning proposed by Mayer (2009), effective learning occurs when students actively process information through the integration of visual and verbal representations. Consequently, conventional teaching approaches that rely heavily on lectures and static materials tend to limit students' opportunities to construct knowledge actively, thereby reducing the effectiveness of physics learning.

In this context, interactive video-based learning emerges as a promising solution, as it combines visual explanations, animations, and interactive elements that can enhance student engagement. Interactive videos also enable active participation through embedded questions, feedback, and conceptual scaffolding, which are essential for promoting deeper understanding and sustained learning motivation.

Previous studies have demonstrated that video-based learning media can positively influence students' learning outcomes in science education. Several researchers (Author, Year) reported that instructional videos improved students' conceptual understanding and academic achievement in physics; however, most of these studies primarily focused on cognitive outcomes without thoroughly examining students' learning motivation.

Conversely, other studies have explored learning motivation but did not analyze its direct relationship with physics learning outcomes, indicating a significant research gap. Therefore, there is still limited empirical evidence that comprehensively investigates the simultaneous impact of interactive video-based learning on both motivation and learning outcomes.

Addressing this gap, the present study offers a novel contribution by integrating interactive video learning media designed based on multimedia learning principles, emphasizing interactivity, visual representation, and active engagement. The study is grounded in the Cognitive Theory of Multimedia Learning (Mayer, 2009) and motivation theory, and it focuses on examining the effect of interactive video-based learning on students' motivation and physics learning outcomes at the secondary school level. The primary objective is to determine whether the implementation of such media significantly improves students' motivation and learning outcomes compared to conventional instructional methods, thereby contributing to the advancement of technology-enhanced learning practices in physics education.

RESEARCH METHOD

This study employed a quantitative approach using a quasi-experimental method, as outlined by Creswell (2014), with the primary objective of examining the causal relationship between the use of interactive video-based learning media and students' motivation and learning outcomes in physics. This approach was selected because it enables systematic comparison of instructional interventions

within controlled educational settings, thereby providing robust empirical evidence regarding the effectiveness of the applied treatment.

The research design implemented in this study was a non-equivalent control group design, which aims to analyze differences in students' motivation and learning outcomes between an experimental group and a control group. Both groups were administered a pretest and posttest; however, only the experimental group received instruction through interactive video-based learning, while the control group was taught using conventional methods. This design was chosen due to its suitability for educational contexts where random assignment is not feasible, yet comparative analysis remains essential to evaluate intervention effectiveness.

The participants in this study consisted of two classes of senior high school students, totaling approximately 60–70 individuals, including one experimental class and one control class. The sampling technique employed was cluster sampling, following the procedures described by Sugiyono (2017), in which intact classroom groups were selected as research samples. Both groups were considered to have relatively similar academic characteristics to ensure the comparability of results, with the experimental class receiving treatment through interactive video-based learning and the control class undergoing traditional instruction.

Data collection was conducted using multiple research instruments, including a learning motivation questionnaire, a physics learning outcomes test administered as both pretest and posttest, and observation sheets to monitor the implementation of the learning process. All instruments were validated by experts in physics education to ensure content validity. The reliability of the motivation questionnaire was tested using Cronbach's Alpha, yielding a coefficient of $\alpha = 0.85$, which indicates a high level of reliability. The data collection procedure was carried out in several stages, beginning with the administration of a pretest to both groups to assess baseline ability, followed by the implementation of the instructional treatment, and concluding with the administration of a posttest and motivation questionnaire to measure the impact of the intervention.

The collected data were analyzed using both descriptive and inferential statistical techniques, in accordance with the procedures described by Sugiyono (2017). Descriptive statistics were employed to calculate the mean, standard deviation, and distribution patterns of students' motivation and learning outcomes. Furthermore, the normalized gain (N-gain) test was used to evaluate the extent of improvement in students' learning outcomes before and after the treatment, while the independent samples t-test was applied to determine the statistical significance of differences between the experimental and control groups. All data analyses were conducted using SPSS software version 25 to ensure accuracy and reliability in the interpretation of results.

RESULTS AND DISCUSSION

Based on the data obtained from the implementation of interactive video-based physics learning, the findings are systematically organized in accordance with the research focus, which includes students' learning motivation and learning outcomes. These findings are subsequently analyzed using both descriptive and inferential statistical approaches to evaluate the effectiveness of the instructional method in comparison with conventional teaching practices. Furthermore, the results are critically interpreted by linking them to relevant theoretical frameworks and supported by previous empirical studies, thereby providing a comprehensive understanding of the impact of interactive video use in physics learning.

The results of the pretest and posttest measurements in the experimental class indicate a substantial increase in the average learning outcome score from 63.20 to 85.10, reflecting a gain of 21.90 points following the implementation of interactive video-based learning. This improvement suggests that students were able to better comprehend physics concepts through the integration of

visualization and interactive elements. In addition, students' learning motivation increased significantly from an average of 68.50 to 82.30, indicating enhanced interest and engagement during the learning process. In contrast, the control class exhibited relatively lower improvements in both learning outcomes and motivation, thereby reinforcing the conclusion that interactive video-based learning provides a more effective learning experience than conventional methods.

Moreover, the results of the statistical analysis using an independent samples t-test reveal a significance value of 0.001 < 0.05, indicating a statistically significant difference between the experimental and control groups in terms of both learning outcomes and motivation. This finding confirms that the use of interactive video has a significant positive effect on the improvement of these variables, thus supporting the research hypothesis. Additionally, the N-gain analysis shows that the experimental class achieved a high category (g = 0.74), while the control class fell into the medium category (g = 0.45), indicating a more optimal level of improvement in the experimental group. From a qualitative perspective, students in the experimental class appeared more active, enthusiastic, and engaged in discussions, suggesting that interactive video media enhances not only cognitive aspects but also affective dimensions of learning.

Further analysis reveals that the standard deviation in the experimental class decreased from 9.10 in the pretest to 6.35 in the posttest, indicating a more homogeneous distribution of students' understanding following the intervention. The consistency of the N-gain with a standard deviation of 0.08 also suggests that the improvement was evenly distributed among most students. On the other hand, the margin of error of ±2.8 points with a relative error percentage of approximately 3.4% indicates that the collected data possess a high level of accuracy and reliability in representing actual conditions. Therefore, these results strengthen the conclusion that the observed improvements are not due to random variation but rather a direct effect of the implementation of interactive video-based learning.

From a theoretical perspective, the improvement in students' learning outcomes and motivation can be explained through Mayer's Cognitive Theory of Multimedia Learning, which posits that meaningful learning occurs through the simultaneous integration of visual and verbal information. In this context, the use of interactive video enables students to construct more accurate mental representations of abstract physics concepts through animations, simulations, and interactive questioning. Furthermore, the increase in learning motivation aligns with motivational theories that emphasize the importance of engaging and relevant learning experiences in fostering intrinsic motivation, thereby making active participation a key factor in successful learning.

In addition, the findings of this study are consistent with previous research demonstrating the effectiveness of multimedia-based instructional media in enhancing conceptual understanding and learning motivation. Studies by Xie et al. (2021), Fadhilah et al. (2021), and Sari et al. (2022) consistently report that multimedia-based and student-centered approaches significantly improve engagement and learning outcomes. However, these findings differ from those of Kurniawan (2019), who reported no significant effect of video-based learning, possibly due to the use of passive video without interactive elements. Furthermore, the present findings reinforce the concept of interactive engagement proposed by Hake (1998), demonstrating that interactive video can serve as an effective implementation for improving learning gains in modern physics classrooms.

Therefore, this study makes a significant contribution to the development of physics education, particularly in the innovation of digital technology-based learning. Practically, the findings can serve as a reference for designing more interactive, engaging, and effective instructional media to improve learning quality. Theoretically, this research strengthens the application of multimedia learning theory within the context of physics education and supports the integration of technology in creating adaptive and innovative learning environments. More broadly, this study also contributes to

the advancement of digital learning approaches that are aligned with the demands of 21st-century education.

Nevertheless, this study has several limitations, including a relatively small sample size and a short implementation duration, which may affect the generalizability of the findings. Additionally, the study focuses solely on motivation and learning outcomes without exploring other aspects such as critical thinking skills, problem-solving abilities, or long-term retention. Therefore, future research is recommended to involve larger and more diverse samples and to employ longitudinal designs to examine long-term effects. Furthermore, integrating interactive video with other instructional models such as problem-based learning or inquiry-based learning, as well as incorporating advanced technologies such as virtual laboratories and learning analytics, is expected to provide a more in-depth and comprehensive understanding of the physics learning process.

CONCLUSION

Based on the research findings on the effect of interactive video-based learning on students' motivation and physics learning outcomes, it can be concluded that this study successfully achieved its primary objective. This study aimed to analyze the extent to which the use of interactive learning videos enhances students' motivation and learning outcomes compared to conventional instructional methods, and the results clearly demonstrate a significant positive impact of the implemented intervention.

The findings reveal that the implementation of interactive video-based learning significantly improved students' learning outcomes, as evidenced by the increase in average scores and a high normalized gain value ($g = 0.74$). In addition, students' learning motivation showed a substantial improvement following the intervention, indicating higher levels of engagement and interest in learning physics. Furthermore, the analysis confirms that students exposed to interactive video learning achieved better conceptual understanding and demonstrated higher motivation than those in conventional learning settings, thereby validating the effectiveness of this approach in enhancing both cognitive and affective learning domains.

This research contributes significantly to the advancement of physics education by developing and validating interactive video-based learning as an innovative instructional model capable of improving students' conceptual understanding and learning motivation. From a theoretical perspective, the study reinforces the application of multimedia learning theory, while practically, it provides a valuable reference for educators in designing effective, technology-integrated instructional media that align with contemporary educational needs.

Moreover, the findings offer strategic implications for strengthening physics education at both national and international levels. At the national level, this study supports the development of innovative teaching strategies and digital learning media to enhance the quality of physics education in schools, as well as informing educators and policymakers about the critical role of technology integration in modern classrooms. At the international level, this study enriches the global body of knowledge in physics education by providing empirical evidence on the effectiveness of interactive video-based learning, thereby fostering further research, encouraging innovation in digital learning environments, and supporting the expansion of international academic collaboration.

Future research is recommended to extend the scope of this study by involving larger and more diverse samples across various educational levels and contexts to improve generalizability. In addition, subsequent studies are encouraged to incorporate additional variables, such as critical thinking skills, problem-solving abilities, and long-term knowledge retention, to obtain a more comprehensive understanding of learning outcomes. Furthermore, future investigations may explore the integration of interactive video learning with other instructional approaches, such as problem-

based learning and inquiry-based learning, as well as the utilization of advanced technologies, including virtual laboratories and augmented reality. Longitudinal research designs are also suggested to examine the sustained impact of interactive video-based learning on students' academic performance and motivation over time.

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