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Development of Interactive Video-Based Learning Media for Physics Material for Students of SMPN 5 Pinrang

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ABSTRACT

This study developed an interactive video-based learning medium for teaching phase changes in matter to seventh-grade students. The medium, designed using the ADDIE model, was validated as highly suitable, practical, and effective. Expert reviews confirmed its alignment with educational standards, while teacher and student feedback highlighted its engaging and user-friendly features. Significant improvements in students' post-test scores, from 58% to 83%, demonstrated its effectiveness in enhancing understanding and motivation. The interactive video also fostered independent learning and critical thinking, addressing challenges in traditional science education. Despite its success, minor technical issues and additional interactivity needs were identified for future refinement. Overall, the medium offers a practical and innovative solution to improve science education outcomes.

Keywords: ADDIE model; interactive video; multimedia learning; science education

INTRODUCTION

The integration of technology into education has become increasingly essential in the modern era, reshaping traditional teaching methods and fostering more effective learning environments. Science, as one of the core subjects in junior high school, holds a pivotal role in equipping students with the skills to understand natural phenomena, solve problems, and apply scientific principles in everyday life. Despite its importance, the teaching of science often faces challenges, particularly in engaging students and ensuring they grasp fundamental concepts. For example, observations at SMPN 5 Pinrang revealed that 60% of seventh-grade students scored below the minimum passing grade of 65, highlighting the limitations of traditional teaching methods such as lectures and rote memorization.

Educational innovation is necessary to address these challenges, with interactive video-based learning emerging as a promising solution. This approach aligns with Mayer's Cognitive Theory of Multimedia Learning, which asserts that combining visual and auditory inputs optimizes students' cognitive processes and enhances learning outcomes (Mayer, 2021). Interactive videos provide dynamic content, including animations, simulations, and quizzes, which cater to diverse learning styles and make abstract scientific concepts more tangible. Zhao et al. (2020) emphasize that interactive multimedia tools significantly enhance engagement and understanding, particularly in subjects requiring visualization of complex processes, such as phase changes in matter.

Furthermore, the constructivist theory of learning underscores the importance of active student involvement in the knowledge construction process. This theory, pioneered by Vygotsky and further expanded by contemporary scholars, highlights how interactive media can foster collaborative learning and critical thinking. By encouraging students to interact

with educational content and solve problems in real-world contexts, interactive videos promote deeper learning and help bridge the gap between theory and practice (Zhao et al., 2020; Naim et al., 2021).

Motivational theories, particularly Deci and Ryan's Self-Determination Theory, further support the use of interactive video-based learning. This theory identifies autonomy, competence, and relatedness as key factors in driving intrinsic motivation (Ryan & Deci, 2020). Interactive videos address these dimensions by allowing students to learn at their own pace, providing immediate feedback, and enabling meaningful connections with the material. Research indicates that students who engage with such tools demonstrate higher levels of motivation and better academic performance (Latifa et al., 2020).

The design and implementation of interactive video-based learning are best guided by systematic frameworks such as the ADDIE model (Branch & Dousay, 2015). This model comprises five stages—Analysis, Design, Development, Implementation, and Evaluation—ensuring that the developed media aligns with educational objectives and meets students' needs. The ADDIE framework facilitates the creation of high-quality, learner-centered materials that not only enhance comprehension but also foster critical thinking and problem-solving skills.

The efficacy of interactive video-based learning is well-documented in the literature. For instance, Mayer et al. (2017) found that integrating videos with interactive elements improved students' retention rates and comprehension of scientific concepts by over 30% compared to traditional methods. Similarly, Issa et al. (2013) demonstrated that medical students who utilized interactive multimedia scored significantly higher on assessments than those taught through lectures alone. These findings are echoed in studies by Latifa et al. (2020) and Naim et al. (2021), which highlight the ability of interactive videos to make learning more engaging and effective, even in remote and online settings.

Given these advantages, this research focuses on developing an interactive video-based learning medium tailored to teaching phase changes in matter. This topic, a fundamental part of the junior high school science curriculum, is critical for building students' understanding of physical and chemical processes. By employing the ADDIE model, the study ensures that the developed media is both pedagogically sound and practical for classroom use.

This study aims to: 1) develop an interactive video learning medium tailored to teaching phase changes in matter; and 2) assess the validity, practicality, and effectiveness of the developed media in improving students' learning outcomes. The outcomes of this research are expected to contribute to the growing body of literature on multimedia learning and instructional design, offering valuable insights for educators and policymakers. By addressing the limitations of traditional methods and leveraging technology, this study seeks to enhance science education and equip students with the skills necessary for success in an increasingly digital world.

METHODS

This study utilized a research and development (R&D) approach, incorporating the ADDIE model as its design framework. The ADDIE model, which stands for Analysis, Design, Development, Implementation, and Evaluation, was selected to ensure a structured and systematic process in the creation and evaluation of an interactive video-based learning medium for teaching phase changes in matter to seventh-grade students.

The research was conducted at SMPN 5 Pinrang, located in Pinrang Regency, South Sulawesi. The study took place from the proposal approval stage through to the completion of product trials and evaluations. The population of the study consisted of all seventh-grade students at SMPN 5 Pinrang. From this population, a purposive sample of 30 students was selected to represent the broader student demographic.

The primary research instruments used were:

1. **Validation Sheets**: To assess the validity of the interactive video based on content, design, and language, with input from subject matter experts.
2. **Observation Sheets**: Used to evaluate the implementation process and measure students' engagement during the lessons.
3. **Pre-test and Post-test Instruments**: To measure the effectiveness of the interactive video in enhancing students' understanding of the topic.
4. **Questionnaires**: Administered to gather feedback from students and teachers regarding the practicality and usability of the developed learning medium.

Data analysis combined both qualitative and quantitative methods. Qualitative data, derived from observations and questionnaire responses, were analyzed descriptively to identify patterns and insights. Quantitative data, including validation scores and pre-test and post-test results, were analyzed using descriptive statistics to determine the learning gains and the validity of the interactive video.

The use of the ADDIE model as the design framework ensured a comprehensive approach, from analyzing educational needs to evaluating the developed product's effectiveness in real classroom settings.

RESULTS AND DISCUSSION

The development and evaluation of an interactive video-based learning medium for the topic of phase changes in matter yielded promising results. The product was designed using the ADDIE model, ensuring a systematic approach from the initial analysis through to implementation and evaluation. Validation, practicality, and effectiveness assessments were conducted to determine the quality and impact of the learning medium.

The validation process involved three expert reviewers specializing in content, media design, and language. The validation results can be seen in the following diagram.

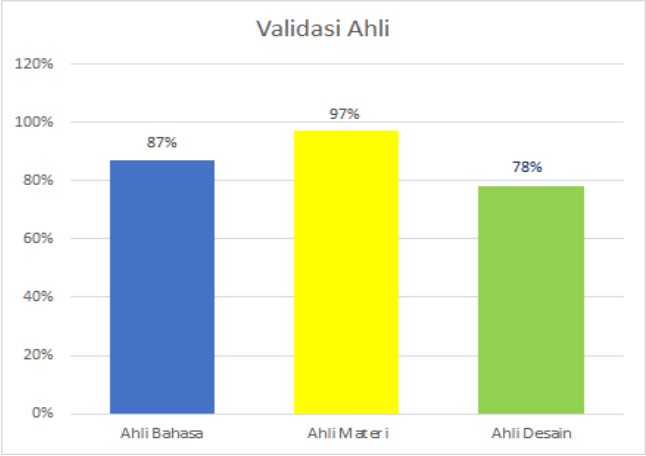

Figure 1. Expert validation result diagram

The content expert rated the video with a validity score of 97%, indicating that the material was highly accurate and aligned with the curriculum. The media design expert provided a score of 78%, categorizing the design as very valid but suggesting minor improvements in visual elements and interactivity. The language expert awarded a score of 87%, reflecting clarity and appropriateness for the target audience. These scores confirmed that the interactive video was well-constructed and suitable for educational use.

The practicality of the learning medium was assessed through teacher and student feedback. Teachers rated the video as 96% practical, highlighting its ease of use and alignment with instructional goals. Students responded positively, with a practicality score of 75%, emphasizing its engaging and interactive features. Observations during the implementation phase revealed increased student participation and enthusiasm, suggesting that the medium successfully addressed motivational gaps observed in traditional teaching methods.

To evaluate effectiveness, pre-test and post-test scores were compared. The average pre-test score of students was 58%, while the post-test score rose to 83%, indicating significant learning gains. These results align with previous studies demonstrating the impact of multimedia learning tools on student comprehension and retention. The interactive features of the video, including animations and embedded quizzes, were particularly effective in helping students grasp abstract concepts such as the processes of melting, freezing, and evaporation.

The findings also underscored the potential of interactive video-based learning to foster independent learning and critical thinking. Students reported that the video allowed them to explore the material at their own pace and encouraged them to ask questions and discuss concepts more actively during lessons. This aligns with constructivist theories of learning, which emphasize the role of active engagement and self-directed exploration in knowledge construction.

Despite its success, the study identified areas for improvement. Some students noted technical issues, such as compatibility with older devices and the need for more interactive elements, such as additional quizzes or real-world simulations. Addressing these limitations in future iterations could enhance the medium's usability and effectiveness further.

Overall, the interactive video-based learning medium proved to be a valid, practical, and effective tool for teaching phase changes in matter. It addressed key challenges in traditional science education by increasing engagement, motivation, and learning outcomes. These findings highlight the potential of integrating interactive multimedia tools into classrooms to enrich the learning experience and support diverse student needs.

CONCLUSION

This study developed an interactive video-based learning medium for teaching phase changes in matter to seventh-grade students. The medium, designed using the ADDIE model, was validated as highly suitable, practical, and effective. Expert reviews confirmed its alignment with educational standards, while teacher and student feedback highlighted its engaging and user-friendly features.

Significant improvements in students' post-test scores, from 58% to 83%, demonstrated its effectiveness in enhancing understanding and motivation. The interactive video also fostered independent learning and critical thinking, addressing challenges in traditional science education. Despite its success, minor technical issues and additional interactivity needs were identified for future refinement. Overall, the medium offers a practical and innovative solution to improve science education outcomes.

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