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Implementation of Video-Based Science Teaching Materials to Improve Elementary School Students' Learning Outcomes

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Abstract: This study aims to implement video-based science teaching materials to improve the learning outcomes of elementary school students. The research method used is a quantitative descriptive method. Science teaching materials combined with contextual learning videos to visualize abstract concepts provide a pleasant learning impression for students. Data were obtained through student response questionnaire sheets related to learning through the implementation of learning videos and learning outcome tests (pretest–posttest). The results showed that the science video teaching materials obtained a score with an implementation test and student response test obtained an average of 89% and the teacher's response as a learning observer was 89%, which means that the science learning videos are easy to use and interesting. From the effectiveness aspect, the increase in learning outcomes by getting an average pretest score of 68, posttest 84, resulting in an N-gain of 0.50. This proves that video-based science teaching materials are effective in improving the learning outcomes of elementary school students with science lessons.

Keywords: Videos, Science, Outcomes

INTRODUCTION

In the era of digital transformation, technology integration in education has become an essential part of improving the teaching and learning process. Science education, in particular, demands teaching strategies that can effectively convey abstract and complex concepts to young learners (Kemdikbud, (2020). Traditional methods, such as textbook-based instruction and oral explanations, often fail to fully engage students or facilitate deep understanding, especially at the elementary school level where students are still developing their cognitive skills (Wisman, 2020). Instructional videos have emerged as a powerful educational tool that combines visual and auditory elements to present scientific concepts in a dynamic and engaging way (Sriadhi et al., (2018). They offer the potential to simplify abstract ideas, illustrate real-world applications, and retain students' attention more effectively than conventional teaching methods (Mutu et al., 2020). The use of multimedia learning materials has been supported by various learning theories, including Mayer's Cognitive Theory of Multimedia Learning, which emphasizes the

role of dual channels (visual and auditory) in enhancing comprehension and retention (Thoriq et al., 2024).

Previous research has shown that instructional videos can increase student motivation, enhance conceptual understanding, and support differentiated instruction Mardhatillah et al., (2023). However, despite their potential, the use of instructional videos in elementary science classrooms in many developing countries remains limited due to lack of resources, training, or awareness of their benefits. This study aims to investigate the impact of using learning videos as science teaching materials on elementary school students' learning outcomes. Specifically, this study seeks to determine whether video-assisted learning can significantly improve students' understanding of science concepts compared to traditional teaching methods. The findings of this study are expected to provide evidence-based insights for educators and policymakers on the effectiveness of integrating video media into elementary science education.

Learning media is a tool that can be used to support the learning process effectively. According to Adam, (2023) media has a function as a supporting tool that enriches students' learning experiences. In this case, Hasanah et al (2020) explains that the term "media" comes from Latin which means intermediary or messenger. One type of learning media that is widely used is learning videos. Nurfadhillah et al., (2021) ; Sari at el (2023) defines learning videos as media that combine audio (sound) and visual motion (moving images) elements, so that they can convey information effectively from teachers to students. The use of video media in learning has a number of significant advantages Santos & Castro, (2021). First, video is able to explain the actual state of a process, phenomenon, or event clearly Sukarini et al (2021). Second, integrating video with other media such as text or images can enrich the explanation of the material Olsson, (2020). Third, users can repeat certain parts to gain a deeper understanding. Fourth, this media is very effective in teaching material related to the behavioral or psychomotor domain Sianturi et al., (2022). Fifth, compared to text media, video is faster and more effective in conveying messages Suryaningtyas et al., (2020). Finally, video can show simulations or procedural steps of a method clearly, making it easier for students to understand it (Santos & Castro, 2021).

METHOD

This study used a quasi-experimental design with a pre-test and post-test format of a non-equivalent control group Ono at el (2020). The purpose of this design was to measure the effect of using learning videos in science learning on student learning outcomes by comparing the results between the experimental group and the control group. This study used a quasi experimental design with a pre-test and post-test format of a different control group. The purpose of this design was to measure the effect of using learning videos in science learning on student learning outcomes by comparing the results between the experimental group and the control group. Participants in this study were 60 fifth-grade students from an elementary school in SD Negeri Linge. They were divided into two groups: The experimental group (n = 30) received science learning using learning videos. The control group (n = 30) received traditional learning using textbooks and oral explanations.

RESULTS AND DISCUSSION

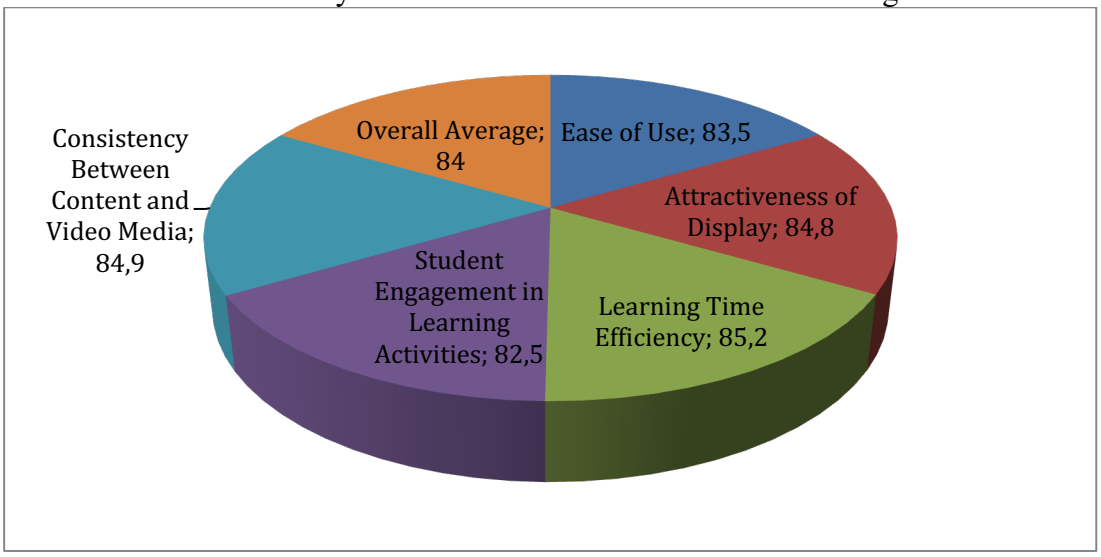
The implementation of digital literacy and video-based learning, which is a crucial competency in the 21st-century learning framework, namely visual learning. The integration of learning videos encourages teachers to become facilitators of inquiry, creativity, and critical thinking, while students learn to apply scientific concepts in real-life contexts. The results of the study showed that the implemented teaching materials received scores on the level of practicality of the teaching materials measured through student response questionnaires and teacher assessments after implementation in the classroom. The research findings showed that students responded positively to the developed teaching materials with an average score of 84%

and teachers understood the learning flow implemented through science learning videos with an average score of 89%. Students argued that videos helped them understand abstract science concepts more easily and made the learning process more interesting. Effectiveness was measured using an evaluation test, namely a pretest and posttest of 30 students. The average pretest score was 68%, while the average posttest score increased to 84%. This increase resulted in an N-gain score of 0.50, which is in the medium to high category. This shows that science video-based teaching materials can be implemented in elementary school students and are effective in improving student learning outcomes. The following data is explained in the table:

Table: 1. Summary of the Practicality Results of Science Teaching Materials Based on Learning Videos

Evaluated Aspect	Average Practicality (%)	Category
Ease of Use	83.5	Very Practical
Attractiveness of Display	84.8	Very Practical
Learning Time Efficiency	85.2	Very Practical
Student Engagement in Learning Activities	82.5	Very Practical
Consistency Between Content and Video Media	84.9	Very Practical
Overall Average	**84.00**	**Very Practical**

Chart 1. Practicality Results of Science Video-Based Teaching Materials



Based on the practicality evaluation results, the developed video-based science teaching materials achieved an overall average practicality score of 84.00%, categorized as "Very Practical." This indicates that the learning media is easy to use, visually appealing, time-efficient, engaging for students, and consistent with the expected learning content. Specifically, the aspect of learning time efficiency achieved the highest score of 85.2%, indicating that the materials help streamline the learning process. Appealing visuals and video content consistency also scored high (84.8% and 84.9%, respectively), indicating that the visual and instructional design effectively supported student understanding. Meanwhile, ease of use (83.5%) and student engagement (82.5%) remained in the "very practical" category, reflecting that the media is user friendly and encourages active participation. These findings indicate that the developed video-based teaching materials are well designed, user oriented, and suitable for classroom implementation to enhance the learning experience.

Table: 2. Statistics of Pre-Test and Post-Test Scores

Number of Students	Pretest Average	Posttest Average	Difference (Δ)	Percentage Increase (%)	N-Gain Score	Category
30	68	84	16	23.5%	0.50	Medium

The effectiveness of the developed science teaching materials was further analyzed using the N-Gain score, which measures the degree of improvement in student learning outcomes between the pre-test and post-test. The data, as presented in the table, shows that 30 students participated in the implementation phase. The average pre-test score was 68, and the average post-test score increased to 84, resulting in a mean difference (Δ) of 16 points. This indicates a 23.5% increase in learning achievement after using the video-based science teaching materials. This finding is consistent with the Cognitive Theory of Multimedia Learning, which states that students learn more effectively when information is presented through a combination of words and images, rather than solely text (Mayang et al., 2020). This improvement also reflects the effectiveness of student centered learning, as videos encourage interaction, curiosity, and inquiry based exploration.

The results indicate that the integration of instructional videos positively contributes to improving students' understanding of science concepts. The visual and audio elements in the videos make abstract topics more concrete, engaging, and easier to understand. Students can observe real-life examples, scientific processes, and animations that reinforce conceptual connections, something often difficult to achieve through verbal explanations alone. The improvements in the experimental group align with previous research (Keskin & Yurdugül, 2020); (Permata Puspita Hapsari & Zulherman, 2021); (A. O. Safitri et al., 2022), which confirms that multimedia based learning improves students' cognitive achievement, motivation, and retention compared to conventional learning. This also supports the Cognitive Theory of Multimedia Learning, which emphasizes that when students process information through verbal and visual channels, they develop deeper understanding. In conclusion, the data show that the experimental class outperformed the control class, confirming that video-based science teaching materials are effective in improving learning outcomes, providing more consistent achievement, and fostering better engagement and understanding among elementary school students. This media combines visual, audio, and interactivity elements to create a more immersive and effective learning experience than conventional methods (M. Sari & Lubis, 2019). Learning videos can increase students' interest in learning science. Students feel more motivated because the material presented becomes more interesting, especially through the use of animation and visualization of scientific processes that are difficult to explain verbally (S. M. Sari et al., (2020). This study noted that student attendance in class increased significantly when learning using video media was introduced. Students who learned using video learning showed significant improvements in cognitive abilities. Video learning helps students understand cause and effect relationships in science concepts through visual simulations (Rustamovna, (2020). In the material on the water cycle, students can see directly how the processes of evaporation, condensation, and precipitation occur sequentially, which is difficult to imagine only through text or static images (Mufida et al., (2021).

The benefits of using educational videos include the ability to explain complex scientific processes, such as photosynthesis and planetary movements. Animations provide a concrete picture of processes that cannot be observed directly with the naked eye. This can help students develop better conceptual understanding and reduce misunderstandings in learning science concepts. The flexibility of educational videos, which allows students to review material as needed, is a major factor in improving learning outcomes (S. M. Sari et al., (2022). In this study, students who were given access to replay educational videos independently showed consistent improvements in test scores. These findings suggest that educational videos can support

students' individual learning needs. Educational videos can increase student engagement in group discussions. After watching the video, students were more active in asking questions and providing arguments related to the material presented. This interaction not only strengthens student understanding but also encourages the development of critical thinking skills (Maulida & Sari, (2024). Emphasizes that the success of using educational videos is highly dependent on the quality of the video it self (Mutu et al., 2020). Videos designed with attractive visual elements, clear narratives, and relevance of content to the curriculum have a greater impact on improving student learning outcomes than videos that do not meet these criteria. Teachers must be involved in the video creation process to ensure that the material created is in accordance with student needs (W. Safitri et al., 2024). There are several obstacles in implementing educational videos, especially in areas with limited technological infrastructure. Limited access to electronic devices and internet connections are the main challenges. This study suggests government support to provide adequate technological facilities in schools.

Figure: 1. Education with Learning Videos

Educational video instruction is an innovative, technology-driven, student-centered approach that is significantly transforming the teaching and learning process in the modern classroom. When properly designed and regularly integrated into lessons, video instruction serves not only as a supplementary visual aid but also as a powerful pedagogical tool that can enhance conceptual understanding, engagement, and long-term knowledge retention (Pujiati et al., 2022). Video instruction makes the learning process more engaging and interactive by combining visual, auditory, and sometimes kinesthetic elements. These multimodal presentations accommodate diverse learning styles: visual learners benefit from animations and demonstrations, auditory learners from explanations and narration, and kinesthetic learners from virtual simulations or guided activities (Rosni, 2021). As a result, students are more likely to grasp abstract scientific concepts, connect theoretical knowledge to real-world phenomena, and maintain their attention throughout the lesson. Video instruction can increase the accessibility of learning materials (Astutik, 2020). Students can replay content, pause for reflection, and learn at their own pace, supporting an individualized and inclusive learning experience (Ammy & Wahyuni, 2020). This feature is especially beneficial for students who need more time to process information or for those in remote areas with limited access to face-to-face learning. Video based learning aligns with the principles of equitable and inclusive education in the digital age (Caella & Yulianto, 2024). The effectiveness of video instruction is not solely determined by the quality of the media itself, but also by how well it is integrated into pedagogical practices (Mutu et al., 2020). Teachers play a crucial role as facilitators, guiding students to think critically, ask questions, and engage in problem solving activities related to the video content. Videos should be designed to encourage interaction and reflection,

rather than passive viewing. For example, teachers can integrate questioning techniques, discussion questions, or project-based assignments after video sessions to deepen students' cognitive engagement. Combining video with constructivist and inquiry based learning strategies can stimulate students' curiosity and scientific reasoning (Putri & Admoko, 2022). This approach helps students construct their own understanding, rather than simply memorizing facts, thus fostering higher-order thinking skills such as analysis, synthesis, and evaluation. More broadly, the integration of video instruction contributes to the development of digital literacy and lifelong learning skills, preparing students to navigate an increasingly information-rich and technology driven world. It supports 21st-century learning competencies of communication, collaboration, creativity, and critical thinking, which are essential for students' future academic and professional success. Learning videos have been proven to make education more engaging, accessible, and effective, but their impact depends heavily on the quality of instructional design and pedagogical integration. Videos should be complemented by active learning strategies, collaborative activities, and reflective discussions to maximize their educational value. Thus, the synergy between technology and pedagogy forms the foundation for meaningful, inclusive, and transformative learning experiences in modern education.

Figure: 2. Sains Learning With Videos

The Importance of Teacher Training to Optimize the Use of Learning Videos (Winarti et al., (2021). Teachers need to be equipped with skills in selecting and integrating learning videos into lesson plans (Pratiwi & Kasriman, 2022). Without adequate training, the benefits of learning videos cannot be maximally accessed (Yuanta, 2020). The use of learning videos as science teaching materials has proven effective in improving elementary school students' learning outcomes. With quality design and adequate technological support, learning videos can be an innovative and inclusive medium (S. M. Sari, 2023). Optimal implementation also requires synergy between content development, teacher training, and provision of technological infrastructure. Collaborative efforts can create more engaging and meaningful science learning for students (Munfiatik, 2023). This development also aligns with the goals of 21st-century education, which emphasize digital literacy, creativity, and self directed learning. By integrating technology into science education, teachers can foster an environment that encourages inquiry, collaboration, and innovation (Limiansih & Dewi, 2023). The use of video-based materials also promotes sustainable learning resources that can be easily disseminated and updated according to curriculum developments. In conclusion, video-based science teaching materials have proven to be innovative pedagogical tools that improve not only students' academic performance but also their motivation, engagement, and scientific literacy

(Nur'aini et al., 2021). The model developed in this study can serve as a reference for educators and curriculum developers in designing interactive, adaptive, and future oriented digital learning resources, supporting the broader goal of improving the quality of science education in the digital era (Perdana & Suswandari, 2021). Based on the literature review, it can be concluded that the use of instructional videos as science teaching materials has a significant positive impact on elementary school students' learning outcomes (Pujiati et al., 2022). Instructional videos can convey abstract concepts visually and interactively, increase student motivation and engagement in the learning process, and support independent learning through their flexible use (Ahyar et al., 2022). Furthermore, the animations and simulations contained in instructional videos help students understand complex concepts more easily. However, the implementation of instructional videos requires adequate technological infrastructure support and special training for teachers to optimize their use. By overcoming these obstacles, instructional videos have great potential to continuously improve the quality of science education in elementary schools. Educators are advised to use creative and innovative teaching materials or learning media, such as modified instructional videos, to improve student learning outcomes.

CONCLUSION

This study concludes that the development of video-based science teaching materials has a significant positive impact on the quality of science education in elementary schools. The integration of multimedia elements such as visual animations, narratives, and contextual examples enhances conceptual understanding and student learning engagement. The learning videos serve not only as supplementary materials but also as a core component of a constructivist learning approach, where students actively construct meaning through observation, exploration, and reflection. Validation results from content, media, and instructional design experts confirmed that the developed materials met the criteria for validity, practicality, and effectiveness. Teachers felt the materials were easy to implement in classroom learning, adaptive to various science topics, and capable of encouraging interactive and student centered learning. Meanwhile, students responded positively, demonstrating high enthusiasm and curiosity when interacting with video-based learning activities. The implementation phase showed significant improvements in student learning outcomes, particularly in understanding scientific processes, problem-solving, and critical thinking skills. Improved post-test scores indicate that visual-based learning can bridge the gap between abstract scientific concepts and real-world phenomena. Furthermore, the video format supports inclusivity in learning by accommodating diverse visual, auditory, and kinesthetic learning styles.

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