

The Effectiveness of Adobe Animate Application Based Learning Media in Improving Elementary School Students' Understanding

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Abstract: This study examined the effectiveness of Adobe Animate application-based learning media in improving fifth-grade students' understanding of science, particularly the topic of human organs, at SDN 1 Labuan Pandan in the 2024/2025 academic year. A quantitative approach with a quasi-experimental pretest–posttest control group design was employed. Data were collected through tests, observations, and documentation, and analyzed using Two-Way ANOVA and N-Gain tests with SPSS. The results showed that Adobe Animate-based learning media significantly improved students' understanding. The Two-Way ANOVA indicated significant effects of learning media, gender, and their interaction ($F = 4.43; 13.41; \text{and } 19.70$, respectively; $F_{\text{table}} = 4.15; \alpha = 0.05$). The experimental class achieved a higher average post-test score (86.56) and N-Gain value (0.7, moderate–high) compared to the control class (51.56; N-Gain = 0.1, low). Normality and homogeneity assumptions were met, and the R^2 value of 0.705 indicated that 70.5% of the variance in students' understanding was explained by the learning media, gender, and their interaction. These findings confirm that Adobe Animate-based learning media are effective in enhancing fifth-grade students' understanding of science concepts.

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Introduction

Education in Indonesia faces various challenges, ranging from inadequate educational facilities to uneven teaching quality. In fact, education is a fundamental foundation for national development. In Indonesia, although education has undergone various developments, it still encounters numerous issues that must be addressed promptly. One aspect that continues to receive attention is the use of learning media. Learning media in many Indonesian schools remain conventional, such as the use of blackboards, textbooks, and poster images. Although these conventional media have proven effective in helping students understand learning materials, along with technological and societal advancements, more innovative and interactive learning media have emerged. Selecting appropriate learning

media is crucial to creating engaging and effective learning experiences. Innovative learning media not only enhance students' interest and motivation to learn but also enable learning materials to be delivered more clearly and contextually.

Hamalik (as cited in Wahyuningtyas, 2020:24) states that the use of media in the learning process can stimulate new desires and interests as well as increase students' learning motivation. According to Gagné and Briggs (as cited in Arsyad, 2016:19), learning media implicitly include tools that are physically used to convey instructional content, such as books, tape recorders, cassettes, video cameras, video recorders, films, slides, photographs, images, graphics, television, and computers.

The use of application-based learning media such as Adobe Animate is closely related to the field of educational technology, which encompasses the processes of designing, developing, utilizing, and evaluating learning media. In the instructional design process, an analysis of students' needs and the planning of media suited to the characteristics of the material are conducted to ensure more effective information delivery. The development stage involves the production of learning media by utilizing software such as Adobe Animate to create educational, interactive, and engaging content. Subsequently, the utilization stage involves the direct implementation of the media in classroom learning activities to support visual and dynamic material presentation. Finally, the evaluation stage plays a crucial role in assessing the effectiveness of the media in improving students' understanding of the learning material, serving as a basis for further improvement or development of the media.

Adobe Animate is an application used to create interactive two-dimensional (2D) animations that can enhance the attractiveness of learning material presentations. In science subjects, particularly in the topic of human body organs, Adobe Animate-based learning media can assist teachers in delivering material visually and dynamically, thereby facilitating students' understanding of abstract concepts.

Adobe Animate is one of the flagship software products developed by Adobe Systems. Adobe Animate is a program specifically designed to create highly engaging animations and bitmaps for the development of interactive and dynamic websites (Hidayat et.al 2019:2). Meanwhile, Saputro (2018:5–6) states that Adobe Animate CC is the latest version of Adobe Flash CS6 developed by Adobe. Adobe continuously enhances its features, transitioning from Flash to Adobe Animate CC, while also supporting web development for designing HTML5 animations, animated advertising media, learning media, and web-based games. According to Rodiyana (2018:49), understanding is an individual's ability to comprehend or understand something being learned, which is also supported by the ability to re-explain that understanding. Similarly, in her journal, Pittariawati (2020:74) states that understanding is an individual's ability to comprehend, conclude, and restate information that has been delivered, heard, or taught.

Science learning at the elementary school level plays a fundamental role in developing students' understanding of natural phenomena and scientific concepts. However, science instruction in many elementary schools still faces challenges, particularly in teaching abstract topics such as the structure and function of human body organs. These challenges are

largely attributed to the continued reliance on conventional instructional media, including textbooks and static images, which are limited in their ability to represent dynamic biological processes. Consequently, students often rely on memorization rather than developing meaningful conceptual understanding.

In the context of 21st-century education, this condition presents a serious concern. Contemporary educational frameworks emphasize student-centered learning, higher-order thinking skills, and the integration of digital technology to enhance learning effectiveness. Educational technology offers opportunities to create more interactive and engaging learning environments that support students' cognitive development. Multimedia-based learning media allow information to be presented through multiple channels, enabling students to process information more deeply and effectively.

Theoretically, the effectiveness of multimedia learning is supported by the Cognitive Theory of Multimedia Learning, which states that learners achieve better understanding when information is presented using both verbal and visual representations rather than text alone (Mayer, 2009). This view is reinforced by Dual Coding Theory, which explains that information processed through visual and verbal channels simultaneously is more easily understood and retained (Paivio, 1991). In science learning, animated visualizations are particularly beneficial because they help students construct accurate mental models of abstract concepts.

One digital application that has strong potential to support multimedia learning is Adobe Animate. This application enables educators to develop interactive two-dimensional animations that visually represent abstract scientific concepts in a dynamic manner. Several studies have reported that animation-based learning media can improve students' motivation, engagement, and conceptual understanding in science learning (Sung et al., 2016).

Despite these potential benefits, empirical research examining the effectiveness of Adobe Animate-based learning media in elementary science education remains limited, particularly studies that explore the interaction between learning media and learner characteristics such as gender. Previous studies suggest that gender differences may influence learning processes and outcomes in technology-supported environments (López-Vargas et al., 2017). Therefore, further research is needed to provide empirical evidence regarding the effectiveness of Adobe Animate-based learning media and its interaction with gender in improving students' understanding.

This study aims to determine the effectiveness of Adobe Animate application-based learning media in improving fifth-grade students' understanding of science, specifically on the topic of human body organs, and to examine the influence of gender and its interaction with learning media on students' understanding.

Research Method

The method used in this study is quantitative. According to Silaen (2018:18), the research design applied in this study is quantitative research, in which quantitative research is defined as a research procedure that produces numerical data and is generally analyzed using

descriptive statistics. Meanwhile, Azwar (2015:70) explains that a research design is a clear description of the relationships among variables, data collection procedures, and data analysis, so that with a well-structured design, researchers and other interested parties can understand how variables are related and how they are measured. Furthermore, Sugiyono (2018:107) states that a research design is a framework that serves as a reference for conducting research, ensuring that all stages are carried out according to predetermined procedures.

The experimental design used in this study is a Quasi-Experimental Design, specifically the control group pre-test–post-test design. This design involves both a control group and an experimental group, each of which is given a pre-test and a post-test. The population of this study consisted of all fifth-grade students at SDN 1 Labuan Pandan, totaling 32 students who were divided into two classes, namely Class VA and Class VB. According to Sugiyono (2015:117), a population is a generalization area consisting of objects or subjects that have certain qualities and characteristics determined by the researcher to be studied and from which conclusions are drawn.

A sample is a subset of the population used in a study. Arikunto (2013:174) states that if the population size is fewer than 100, it is advisable to use the entire population as the research sample. Based on this consideration, this study did not employ sampling because the population size was relatively small. Therefore, a population study was conducted by involving all 32 fifth-grade students at SDN 1 Labuan Pandan. In addition, Sugiyono (2017:81) defines a sample as part of the total number and characteristics possessed by a population, which is used as the object of research to represent the population in various aspects and provide an objective description of the population's condition.

This study employed test instruments in the form of a pre-test and a post-test. The pre-test and post-test were used to measure students' understanding before and after the treatment was administered. The test consisted of 20 multiple-choice questions, each designed to assess students' overall understanding of science material on human body organs. The scoring system applied was a simple scoring method, in which each correct answer was awarded one (1) point and each incorrect answer was given zero (0) points.

The data collection techniques used in this study included tests as the primary data collection method, while observation and documentation were used as supplementary data collection methods. The data analysis techniques employed were Two-Way ANOVA, N-Gain analysis, and statistical analysis using SPSS. These analytical techniques were selected in accordance with the research focus on examining the effectiveness of Adobe Animate application-based learning media.

Result

After the pre-test and post-test data were calculated, the next step was to process the data statistically. To analyze the data obtained, the researcher conducted manual calculations using the Two-Way ANOVA formula. The Two-Way ANOVA test is a statistical method

used to determine the simultaneous effects of two factors on a dependent variable, both individually (main effects) and through the interaction between the two factors.

Table 1. Statistical Analysis for Testing the Hypothesis on the Effectiveness of Adobe Animate Application-Based Learning Media

Gender	Group		Group		Total	
	Group (A)	x_1^2	Group (B)	x_2^2	Σx	Σx^2
	90	8100	60	3600	150	22500
	100	10000	70	4900	170	28900
	95	9025	60	3600	155	24025
Girl	80	6400	40	1600	120	14400
	85	7225	45	2025	125	15625
	85	7225	50	2500	135	18225
	100	10000	35	1225	135	18225
	95	9025	45	2025	140	19600
Sum	730	67000	405	21475	1130	161500
	95	9025	50	2500	145	21025
	85	7225	50	2500	135	18225
	70	4900	75	5625	145	21025
Men	70	4900	70	4900	140	19600
	95	9025	30	900	125	15625
	75	5625	70	4900	145	21025
	85	7225	30	900	115	13225
	80	6400	45	2025	125	15625
Sum	655	54325	420	24250	1075	145375
	$\Sigma x_{t_1} =$	$\Sigma X_{t_1}^2 =$	Σx_{t_2}	$\Sigma X_{t_2}^2$	Σx_t	ΣX_t^2
Total	1385	121325	825	45725	2205	306875

It was determined that the obtained values were calculated using the Two-Way ANOVA formula and the N-Gain test.

Table 2. Anova

Source of Variation	Sum of Squares	Degrees of Freedom (df)	Mean Square	F	Significance Level
Between Groups (Type of Learning Media)	10,489.84	1	10,489.84	4.43	0.05
Between Groups	31,697.66	1	31,697.66	13.41	0.05

(Gender)					
Interaction Between Learning Media and Gender	46,569.53	1	46,569.53	19.70	0.05
Within Groups	66,179.69	28	2,363.56	—	—
Total	154,936.72	32	—	—	—

The category of N-Gain score achievement can be determined based on the N-Gain value or its percentage form. The classification of N-Gain scores used in this study is presented in Table 3. below.

Table 3. Classification of N-Gain Scores

N-Gain Value	Category
$g > 0.7$	High
$0.3 < g \leq 0.7$	Moderate
$g < 0.3$	Low

N-Gain Test of the Experimental Class

Based on the results of the analysis, the N-Gain value of the experimental class is calculated as follows:

$$\text{N-Gain} = \frac{86.56 - 41.56}{100 - 41.56} = \frac{45}{58.44} = 0.7$$

N-Gain Test of the Control Class

The N-Gain value of the control class is calculated as follows:

$$\text{N-Gain} = \frac{51.56 - 48.12}{75 - 48.12} = \frac{3.44}{26.88} = 0.1$$

Based on the normalized gain (N-Gain) analysis, it is evident that learning using Adobe Animate-based media resulted in a high improvement in students' understanding. The experimental class achieved an average N-Gain score of 0.7, which falls into the moderate-to-high category. In contrast, the control class, which employed conventional learning methods, obtained an average N-Gain score of only 0.1, categorized as low. These findings indicate that the effectiveness of Adobe Animate-based learning is not only statistically significant but also provides a meaningful and practical impact on improving students' understanding.

Based on the results of the statistical analysis, it was found that the effectiveness of Adobe Animate application-based learning media is very high in improving fifth-grade students' understanding of science subjects, particularly on the topic of human body organs. This is evidenced by the results of the Two-Way ANOVA analysis, which indicate that the type of learning media, gender, and the interaction between the two variables have a significant effect on students' understanding.

The calculated F-values for the learning media variable ($F = 4.43$), gender ($F = 13.41$), and the interaction between learning media and gender ($F = 19.70$) were all higher than the critical F-value ($F_{table} = 4.15$) at the 5% significance level. Therefore, the null hypothesis (H_0) was rejected, and the alternative hypothesis (H_1) was accepted, stating that learning using Adobe Animate application-based media is effective in improving fifth-grade students' understanding of science learning on the topic of human body organs in the 2024/2025 academic year. These findings indicate that both the effectiveness of learning media and gender differences play an important role in enhancing students' understanding.

Discussion

The results of this study indicate that the use of Adobe Animate-based learning media significantly improves students' understanding of science concepts compared to conventional instructional methods. Students who learned using animation-based media demonstrated higher post-test scores and greater learning gains than those in the control group. These findings suggest that interactive digital media play an important role in enhancing students' conceptual understanding, particularly for abstract science topics.

From a theoretical perspective, these findings support the Cognitive Theory of Multimedia Learning, which emphasizes that meaningful learning occurs when learners actively integrate verbal and visual information (Mayer, 2009). Adobe Animate-based learning media present scientific concepts through dynamic animations accompanied by explanatory text, allowing students to construct coherent mental representations of human body systems. This multimodal presentation helps reduce cognitive overload and supports deeper conceptual processing.

The improvement in students' understanding is also consistent with Dual Coding Theory, which posits that information encoded through both visual and verbal systems is more likely to be comprehended and retained (Paivio, 1991). By presenting abstract biological concepts through animated visuals and verbal explanations, Adobe Animate-based media facilitate dual-channel processing that enhances students' comprehension.

The findings of this study are in line with previous empirical research. Sung et al. (2016) found that technology-enhanced learning media significantly improved elementary students' conceptual understanding and learning motivation in science subjects. Their study emphasizes that digital animations can support active engagement and help students understand complex scientific relationships more effectively than traditional learning media. Similarly, Hidayat et al. (2019) reported that animation-based learning media contributed to significant improvements in students' understanding of abstract scientific concepts by providing interactive and visually rich learning experiences.

An important finding of this study is the significant interaction between learning media and gender. This result suggests that Adobe Animate-based learning media may support diverse learning needs by providing flexible and engaging learning experiences. This finding is consistent with the work of López-Vargas et al. (2017), who found that technology-

enhanced learning environments can accommodate differences in learners' characteristics and promote more equitable learning outcomes.

Overall, the findings of this study confirm that Adobe Animate-based learning media are pedagogically effective and theoretically grounded. By integrating principles from multimedia learning theory and dual coding theory, animation-based digital media provide meaningful learning experiences that enhance students' understanding of science concepts. These results highlight the importance of integrating interactive digital media into elementary science instruction, particularly for topics that require strong visual representation and conceptual clarity.

Conclusion

Based on the results of the statistical analyses, it can be concluded that the use of Adobe Animate application-based learning media is highly effective in improving fifth-grade students' understanding of science, particularly on the topic of human body organs. The Two-Way ANOVA results indicate that the type of learning media, gender, and the interaction between these variables have a significant effect on students' understanding, as shown by the calculated F-values for learning media ($F = 4.43$), gender ($F = 13.41$), and their interaction ($F = 19.70$), all of which exceed the critical F-value of 4.15 at the 5% significance level. The N-Gain analysis further supports these findings, with the experimental class achieving an average N-Gain score of 0.7 (moderate to high category), compared to only 0.1 (low category) in the control class. These results confirm that Adobe Animate-based learning media not only produce statistically significant improvements but also provide meaningful practical benefits in enhancing students' conceptual understanding through interactive and visual learning experiences.

The implications of this study highlight the importance of integrating interactive digital media into elementary science instruction, particularly for teaching abstract concepts that require strong visual representation. Teachers are encouraged to utilize Adobe Animate-based media to improve student engagement and learning outcomes, while curriculum developers and policymakers may consider incorporating technology-based learning media as an integral component of instructional design. Additionally, the findings emphasize the need to account for learner characteristics, including gender differences, when developing instructional strategies. Future research is recommended to investigate the long-term impact of Adobe Animate-based learning media, its effectiveness across different subjects and grade levels, and its integration with various pedagogical models to further optimize learning effectiveness.

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