The Effect of Interactive Media Based on Animated Video on Natural Science Process Skills in Elementary School

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Abstract: This research aims to describe interactive media for enhancing student learning outcomes and to analyze the impact of animated video-based interactive media on science process skills. The study utilized a quantitative Nonequivalent Control Group Design with a pretest-posttest involving two classes, IV-A and IV-B, each consisting of 26 students. The instrument used in this study was a multiple-choice test obtained from a test bank. Quantitative data analysis employed statistical procedures, including descriptive and inferential statistics. Based on the research findings, the significance value obtained from the Independent Sample T-Test was 0.00, which is less than 0.05. This indicates that the alternative hypothesis (Ha) is accepted and the null hypothesis (Ho) is rejected, concluding that animated video-based interactive media significantly influences science process skills. The analysis also revealed that animated video-based interactive media has an 80% impact on science process skills, demonstrating that this type of media effectively enhances science process skills in fourth-grade elementary school students.

Abstrak: Penelitian ini bertujuan untuk mendeskripsikan media interaktif untuk meningkatkan hasil belajar siswa dan menganalisis pengaruh media interaktif berbasis vidio animasi terhadap keterampilan proses IPA. Jenis yang digunakan dalam penelitian ini adalah kuantitatif desain *NonequivalentControlGroupDesign* pretest-postest, sehingga sampel pada penelitian ini membutuhkan dua kelas yaitu: siswa kelas IV-A dan IV B yang berjumlah 26 orang masing-masing kelas. Instrumen pada penelitian ini yaitu: tes pilihan berganda yang diperoleh dari bank soal. Analisis data penelitian kuantitatif menggunakan prosedur statistik (*statistical procedure*) atau analisis statistik (*statistical analysis*). Analisis statistik yang digunakan pada penelitian kuantitatif terbagi atas dua fungsi, yaitu: statistik deskriptif, dan statistik inferensial. Berdasarkan hasil penelitian diperoleh nilai sig pada uji *Indenpendent Sample T-Test* sebesar 0,00 lebih kecil dari 0,05. Hal ini mengindikasi bahwa Ha diterima dan Ho ditolak, sehingga dapat disimpulkan bahwa terdapat pengaruh media interaktif berbasis vidio animasi terhadap keterampilan proses IPA. Pada hasil analisis juga ditemukan bahwa penggunaan media interaktif berbasis vidio animasi memberikan pengaruh sebesar 80% terhadap keterampilan proses IPA, sehingga dapat disumpulan bahwa media interaktif berbasis vidio animasi mampu meningkatkan keterampilan proses ilmu pengetahuan alam kelas IV SD.

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A. Introduction

Natural Sciences (IPA), also called Science, is a discipline that systematically explores natural phenomena through human experimentation and observation (Samatoa, 2016). Understanding natural Science is crucial for human life due to our continuous interaction with the natural world. Hence, science education commences early, beginning at the elementary school level. In the 2013 curriculum for elementary schools, science instruction varies across grades, integrating science content with other subjects like Indonesian in lower grades and focusing on fundamental science competencies in higher grades. Teaching Science in schools aims to cultivate students' knowledge, scientific attitudes, and process skills (Jannah et al., 2022).

Elementary school science education must evolve with contemporary demands, adapting to the 21st century or the Fourth Industrial Revolution era, emphasizing digital technology and 21st-century learning skills. These skills encapsulated as the 4Cs—creative thinking, critical thinking and problem-solving, communication, and collaboration—are essential (Partono et al., 2021). Achieving these skills necessitates educators to design learning plans incorporating activities that foster the 4Cs (Septikasari & Frasandy, 2018).

The 21st century is characterized by digitalization, where digital technology permeates all facets of life, including education. Digitalization comprehensively transforms conventional activities into digital-based ones. Through digital innovations, teachers are encouraged to integrate traditional and digital classroom learning methods. These innovations encompass the development of teaching materials (Agustin et al., 2020), instructional media (Maisarah et al., 2022), report card applications (Rosmini et al., 2021), and assessments (Wijayanti et al., 2023). These adaptations not only respond to the digital era but also support the implementation of the Independent Curriculum.

The Independent Curriculum is phased in gradually: initially in grades I and IV, extending to grades I, II, IV, and V in the second year, and encompassing all elementary school grades by the third year. It aims to cultivate six Pancasila Student profiles: global diversity, collaboration, creativity, critical reasoning, independence, and noble character (Maisarah, 2023). Furthermore, the curriculum integrates Natural Sciences and Social Sciences into Integrated Science and Social Studies (IPAS), promoting cohesive management of natural and social environments (Maisarah & Prasetya, 2023).

Fundamental components of Science encompass scientific attitudes, processes, and products (Pramana et al., 2022). Encapsulated as science process skills, the scientific process plays a pivotal role in science education. Effective science education should foster critical reasoning, and a Pancasila Student Profile should be closely linked to science process skills. Students with essential reasoning skills can objectively process information, analyze, evaluate, and draw conclusions. Indicators of critical reasoning include acquiring and processing data, analyzing and assessing reasoning, reflecting on thoughts, and making decisions (Kemdikbud, 2020).

Science process skills suitable for elementary students encompass observing, classifying, predicting, and concluding, aligning with critical reasoning indicators (Rizal et

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al., 2022). Interactive learning strategies employing animated videos can enhance these skills and nurture essential reasoning. Initial observations at SD Muhammadiyah 01 Medan highlight the necessity for optimal use of available facilities and enhancements in students' science process skills and critical reasoning. Despite the introduction of interactive video-based learning, its impact on science competency remains constrained, compounded by limited resources and teachers' unfamiliarity with interactive media (Rohim & Rigianti, 2023).

Addressing these challenges necessitates optimizing learning facilities and leveraging interactive media based on animated videos, which can make abstract science concepts tangible and understandable for elementary students. Such media enhance student engagement and bolster their science process skills and critical reasoning (Lestari et al., 2023). The research underscores the significant impact of animated video-based interactive media on student learning outcomes (Maryam, 2023; Sholeh & Prapanca, 2023).

This study aims to evaluate the influence of animated video-based interactive media on students' science process skills and critical reasoning abilities, offering insights for educators and researchers. It supports the movement towards digitalizing schools and enhances students' science process skills and critical reasoning through interactive media.

B. Method

This study adopts a quantitative research approach. The research design utilized is a Quasi-Experimental Design, characterized by its quasi-experimental nature due to the lack of complete control over all variables (Sugiyono, 2017). While both a control and an experimental group were present, they were not randomly selected and did not constitute a fully randomized sample. In this study, the dependent variable is influenced solely by the independent variable, with minimal consideration for external variables. Science process skills are identified as the dependent variable, while interactive media based on animated videos is the independent variable. The research methodology follows the ten-step framework outlined by Borg and Gall.

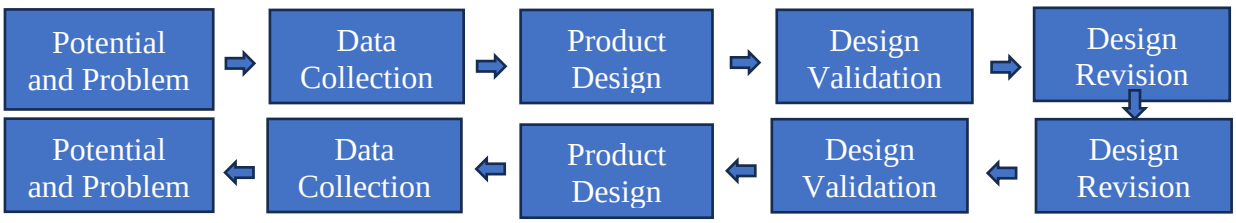

Figure 1. Research Design Flow

The study employed purposive sampling, which involves selecting participants based on specific criteria. These criteria included schools that implement the Independent Curriculum, student characteristics, and obtaining permission from the school authorities. One such school is Muhammadiyah 01 Medan Elementary School, which has been

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implementing the Independent Curriculum since the 2023/2024 academic year for grades I, II, IV, and V, following regulations set by the Ministry of Education and Culture for phased implementation. The research was conducted exclusively with grade IV students at SD Muhammadiyah 01 Medan, comprising two classes with 26 students each, resulting in a total sample size of 52 students.

Based on this description, the research design used was a one-group pretest-posttest design. The details of the research design can be illustrated in Table 1:

Table 1. Research Design
Nonequivalent Control Group Design

Group	Pre Test	Treatment	Pos Test
Experiment	O2	X	O2
Control	O3	-	O4

Information:
A = Experimental group
B = Control group
O1 = Pre-Test experimental group
O2 = Posttest experimental group
O3 = Pre-Test control group
O4 = Posttest control group
X = Flipbook media treatment based on animated images in imaginative descriptive paragraph writing skills

The data collection method utilized in this study involves administering a test to assess science process skills before and after implementing animated video media. The test data is then analyzed by computing the average percentage scores, which indicate the students' final skill levels. This data is subjected to analysis using both descriptive and inferential statistics. The test instrument grid is designed based on indicators specific to science process skills.

Quantitative data analysis employs statistical procedures, which encompass descriptive statistics for summarizing data and inferential statistics for testing hypotheses and drawing broader conclusions. The inferential statistical tests applied in this study include the Normality Test, Homogeneity Test, and Independent T-Test. All statistical analyses will be conducted using SPSS software to ensure accuracy and prevent calculation errors.

C. Result and Discussion

Result

Data analysis was carried out using the SPSS version 20 program.

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Test the Validity of Question Items

Validity refers to the accuracy and precision of a measurement instrument in assessing its intended constructs. The questions were administered to fourth-grade students at SD Muhammadiyah 01 Medan, and subsequently, their validity was evaluated using IBM SPSS Statistics 20 for Windows. Criteria for the validity assessment include determining if the sig (2-tailed) < 0.05 or if the R. Count value exceeds the R. Table value, indicating the validity of the test item. From the validity test results, it was determined that out of 30 questions, 20 were deemed valid, while ten were found invalid. Detailed data from the validity test results can be found in Table 2.

Table 2. Question Item Validity Test Results

Questions Items	R. Table	R. Count	Information
Questions 1	0.388	.707	Valid
Questions 2	0.388	.746	Valid
Questions 3	0.388	.410	Valid
Questions 4	0.388	.707	Valid
Questions 5	0.388	.869	Valid
Questions 6	0.388	.822	Valid
Questions 7	0.388	.729	Valid
Questions 8	0.388	.822	Valid
Questions 9	0.388	-.014	Invalid
Questions 10	0.388	.729	Valid
Questions 11	0.388	.294	Invalid
Questions 12	0.388	.304	Invalid
Questions 13	0.388	.516	Valid
Questions 14	0.388	,054	Invalid
Questions 15	0.388	.746	Valid
Questions 16	0.388	.324	Invalid
Questions 17	0.388	.707	Valid
Questions 18	0.388	-.059	Invalid
Questions 19	0.388	.729	Valid
Questions 20	0.388	.707	Valid
Questions 21	0.388	.111	Invalid
Questions 22	0.388	.018	Invalid
Questions 23	0.388	.707	Valid
Questions 24	0.388	-,097	Invalid
Questions 25	0.388	.410	Valid
Questions 26	0.388	.304	Invalid
Questions 27	0.388	.746	Valid
Questions 28	0.388	.822	Valid
Questions 29	0.388	.707	Valid
Questions 30	0.388	.410	Valid

Source: SPSS Data Processing Test (2024)

Based on Table 2, there are a total of 40 question items. Following the validity test, 20 questions were validated, while ten were deemed invalid. This conforms to the testing

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criteria specified by IBM SPSS Statistics 20 for Windows, where a question is considered valid if sig. < (α 0.05) or if r. Count > r. Table.

Reliability Test

The reliability test assesses the consistency of the measurement instrument, ensuring it provides consistent results upon repeated use. In this study, the reliability of the questions was evaluated using Cronbach's Alpha. A Cronbach's Alpha value above 0.60 indicates satisfactory reliability. The results of the reliability test conducted using IBM SPSS Statistics 20 for Windows are detailed in Table 3.

Table 3. Reliability Test Results of Question Items Reliability Statistics

Cronbach's Alpha	N of Items
,737	30

Source: SPSS Data Processing Test (2024)

Based on Table 3, the statistical analysis using IBM SPSS Statistics 20 for Windows revealed a Cronbach's Alpha coefficient of 0.737, which exceeds the threshold of 0.60. This indicates that the 30 questions utilized in this study demonstrate a very high level of reliability, affirming the instrument's dependable consistency.

Normality Test

The normality test evaluates whether the pre-test and post-test data from the control and experimental groups exhibit a normal distribution. Conducted using the Kolmogorov-Smirnov test in IBM SPSS Statistics 20 for Windows, this test determines normality based on a significance level (α) of 0.05. Data is deemed generally distributed if the significance value exceeds 0.05; conversely, it is considered non-normally distributed if the significance value is less than 0.05. The outcomes of the normality test are summarized in Table 3.

Table 4. Normality Test Results for Control and Experiment Class Data Tests of Normality

Class		Shapiro-Wilk		
		Statistic	df	Sig.
Animated Video Media Results	Control Class	,955	26	,305
	Experimental Class	,945	26	,173

Source: SPSS Data Processing Test (2024)

Based on Table 4, the normality test for the outcomes of the animated video media in both the control and experimental classes utilized the Shapiro-Wilk test. The results demonstrate that the data is normally distributed, as indicated by the significance (sig.) values of 0.305 for the control class and 0.173 for the experimental class, both exceeding 0.05.

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Homogeneity Test

Following the normality test, inferential statistical analysis proceeded with a homogeneity test to assess whether the data variances from both classes were comparable. This test, conducted using IBM SPSS Statistics 20 for Windows, determines homogeneity with a significance level (α) > 0.05, indicating homogeneous sample variances. Detailed results of the homogeneity test are presented in Table 4 below:

Table 5. Results of Data Homogeneity Test for Control and Experimental Classes Test of Homogeneity of Variance

Class		Mark Sig.	Information
Animated Video Media Results	Control Class	.879	.879 > 0.05 = Homogeneous
	Experimental Class	.942	.942 > 0.05 = Homogeneous

Source: SPSS Data Processing Test (2024)

Based on Table 5, the homogeneity test results for learning outcomes in both the control and experimental classes indicate that the data show comparable variance. This is evidenced by the homogeneity test results, where the significance value exceeds 0.05, confirming homogeneous learning outcome data.

Independent T-test

Following the normality test results, hypothesis testing proceeded using IBM SPSS Statistics 20 for Windows, specifically employing the Independent T-Test. This test aimed to assess the impact of animated video-based interactive media on the science process skills of fourth-grade students at SD Muhammadiyah 01 Medan. The results of the Independent T-test calculations and the comparison between the control and experimental class values are detailed in Tables 6 and 7.

Table 6. Independent T-test Independent Samples Test

		Levene's Test for Equality of Variances	
		F	Sig.
Animated Video Media Results	Equal variances assumed Equal variances are not assumed.	5,003	,030

Source: SPSS Data Processing Test (2024)

Table 7. Comparison of Control and Experiment Class Values Group Statistics

Class		N	Mean
Animated Video Media Results	Control Class	26	51,62
	Experimental Class	26	80,35

Source: SPSS Data Processing Test (2024)

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Based on the research results, the average values obtained for the control and experimental classes can be seen in Figure 2.

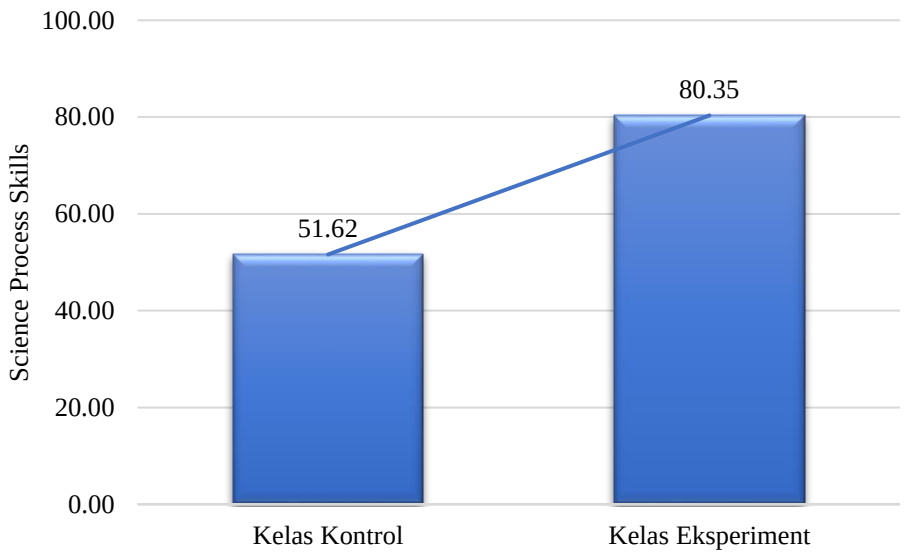

Figure 2. Average Value of Control and Experimental Classes

Figure 2 shows that the average science process skills score in the control class is 51.62, whereas in the experimental class, it stands at 80.35. The hypothesis testing conducted using SPSS 20 for Windows follows specific criteria: if Sig < 0.05, Ha is accepted. Table 5 presents the results of the statistical analysis test, indicating a Sig. of 0.03 < 0.05, which suggests that animated video-based interactive media significantly influences science process skills at SD Muhammadiyah 01 Medan.

Discussion

This research was conducted at SD Muhammadiyah 01 Medan in classes IV A and IV B, implementing different instructional methods: class IV A served as the control group using independent curriculum teaching materials. In contrast, class IV B was the experimental group exposed to animated video-based interactive media. The study aimed to assess science process skills through post-test data and to compare differences in students' science process skills before and after implementing animated video-based interactive media. The primary assessment tool used in this research was a test instrument, which underwent a normality test before application. Initially comprising 30 multiple-choice questions, the instrument was employed in control and experimental classes, yielding customarily distributed data.

The research findings indicated that students exposed to animated video-based interactive media achieved higher average skill scores than those in the control class. Specifically, the average score in the experimental class was 80.35, contrasting with 51.62 in the control class. The normality test affirmed the normal distribution of student skill data at a 95% significance level (α 0.05), with a sig value > 0.05. Subsequently, an independent

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sample t-test was conducted, revealing a sig value of 0.030 < 0.05. Hence, Ho is rejected, and Ha is accepted, indicating that the science process skills of students taught using animated video-based interactive media are significantly higher than those taught without this media.

This signifies a notable disparity in student skill outcomes between media-based and non-media-based teaching approaches. Animated video-based interactive media demonstrated substantial efficacy, offering various benefits. According to Amalia et al (2024), interactive media that integrates audiovisual elements enhances engagement and comprehension, stimulates motivation and curiosity, and promotes active learning and critical thinking among students. Isnaini et al (2021) employed the Scratch application as an alternative educational tool for introducing knowledge through animation, enhancing both learning goal attainment and student motivation and interest.

Different educational media possess unique roles and advantages, but effective management by educators or researchers can yield excellent outcomes (Ibrahim, 2022). Andini & Kurniawati (2023) added that interactive media, such as digital learning applications, videos, and simulations, foster student interest in learning and deepen understanding of scientific concepts. Educational media can stimulate learning, ignite student interest and curiosity, and bolster motivation. Interactive learning media also positively affect student psychology, enhancing memory retention and comprehension of complex concepts.

Educational media play a pivotal role in learning, serving as a benchmark for gauging student understanding. Effective media utilization enables educators to elucidate concepts clearly, making learning enjoyable and understandable for students. Video media, a popular information and communication technology, combines auditory and visual elements to deliver dynamic, engaging content that aids in absorbing, comprehending, and retaining educational content. According to Tanjung & Sitepu (2023), animated learning media enhances science process skills and overall student performance, leading to superior learning outcomes compared to traditional methodologies.

Nugroho (2015) highlighted that video media promotes active learning, involving students in activities like observing, demonstrating, performing, and presenting. Video media is particularly effective in teaching practical skills and activity-based training, enhancing teaching efficacy and student achievement. The clarity of instructional material significantly improves through visual and auditory channels, enhancing information retention and comprehension. Visual stimuli effectively capture attention, boosting motivation and engagement in learning activities.

In conclusion, interactive media, encompassing digital learning applications, interactive videos, and simulations, significantly heighten student interest in learning and deepen comprehension of scientific concepts. According to Anggraeni et al (2021), media integration in education stimulates learning, fosters interest and motivation, and positively impacts student psychology by enhancing memory retention and understanding of complex concepts. While the benefits of interactive media are widely acknowledged, further

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investigation is warranted to discern its impact on science education, particularly in fourth-grade settings.

D. Conclusion

Based on the findings of this study, it is evident that animated video-based interactive media significantly enhances science process skills, as demonstrated by the substantial increase in average skill scores following its implementation. This underscores the critical role of animated video-based interactive media in the educational process. The research aimed to illustrate how interactive media improves students' process skills and to analyze its impact on science process skills.

Student feedback on animated video-based interactive media, evaluated among fourth-grade elementary students, indicated an 80% approval rating in the "very good" category. This attests to the positive influence of animated video-based interactive media on science process skills, receiving a strong endorsement from both students and educators. Consequently, animated video-based interactive media has proven effective in enhancing student learning outcomes, underscored by the higher average post-test score of 80.35 in the experimental class compared to 51.62 in the control class.

For future research, it is recommended that educators integrate animated video-based interactive media into science lessons and prioritize the development of science process skills. This approach can cultivate an engaging, interactive learning environment that reduces learning time while enhancing learning quality and student motivation. Educators should also encourage critical thinking and active student participation, fostering enthusiasm and interest in learning activities. Researchers interested in exploring the impact of video media on science process skills and academic achievement should conduct meticulous observations and assessments of student responses to optimize research outcomes.

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