

Analysis of the Impact of using Digital Storytelling-based Interactive Learning Media on IPAS Comprehension

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Abstract

Purpose: Driven by the low utilization of digital learning media, this study aims to examine the impact of Digital Storytelling-based interactive learning media on students' understanding of IPAS concepts.

Methodology: A quantitative pretest-posttest control group design was used with fifth-grade students at SD Muhammadiyah Program Unggulan Colomadu. Class VA served as the control group and class VB as the experimental group. Data were collected through validated and reliable multiple-choice tests and analyzed using the Shapiro-Wilk test, Levene's test, independent t-test, and paired t-test.

Results: Findings show that the data were normally distributed and homogeneous. The experimental class demonstrated a significant improvement from pretest to posttest, while the control class showed only minimal gain. The independent t-test confirmed significant differences between posttest scores of both groups.

Applications/Originality/Value: The study provides evidence that Digital Storytelling is an effective technology-based learning medium for improving IPAS comprehension and offers a relevant alternative for teachers in designing engaging and interactive digital learning experiences for elementary students.

Introduction Section

The field of education has undergone significant transformation due to the swift advancement of digital technology. According to research by (Yonanda et al., 2024), students' usage of dull and repetitive learning materials frequently results in low motivation and poor learning outcomes. Students are less engaged in the learning process as a result of teachers' continued heavy reliance on PowerPoint presentations without interaction. Innovative media that can produce engaging, pleasurable, and meaningful learning is necessary in this environment. Digital storytelling is one such invention that blends interactive aspects, audio, pictures, and narrative. This method is thought to be successful in assisting students in comprehending ideas, such as the sound and hearing content covered in IPAS classes. In addition to providing knowledge, this media offers primary school children a more engaging educational experience. Additionally, by offering instructive and contextual stories, digital storytelling can develop student character in accordance with the Pancasila student profile.

Nonetheless, the field's reality indicates that digital storytelling media usage is still quite low. Many primary schools continue to use passive lecturing techniques and materials (Atik, 2019) Only over 35% of primary school teachers frequently use digital media in their lessons, according to data (Kemendikbud, 2022) The poor degree of student comprehension of IPAS content is indicative of the impact

Given that IPAS is crucial to developing kids' science literacy from a young age, low comprehension of the subject is a basic issue (Islamati & Asti Nugraha, 2024). Additionally, the learning quality difference between urban and rural schools is widened by certain schools' restricted access to digital media, particularly in places with poor infrastructure (Kurniyanti, 2025) Technology-based learning can greatly improve student motivation and learning outcomes, according to Dzikri (2024) research.

Teachers can successfully communicate information by using digital learning materials (Daryanto et al., 2016). Digital media with appealing designs can make it easier for pupils to comprehend the subject matter and improve their concentration and learning engagement. According to (Yulianti & Minsih, 2022) one of the many benefits of technological advancements in education is the capacity to communicate information more successfully through visual and auditory presentations. Animated videos that narrate stories have also been shown to be successful. (Sanjaya et al., 2021) created animated science knowledge videos for fifth-grade elementary school pupils, and their findings demonstrated a rise in science literacy and comprehension of the subject matter following the use of narrative videos. This supports the claim that digital storytelling can simultaneously enhance students' cognitive and emotive abilities.

Students' cognitive development features are still in the concrete operational stage at the primary school level, necessitating the use of learning materials that can contextualize and graphically present concepts. Because digital stories naturally pique children's interest and enable them to make connections between educational content and their everyday experiences, digital storytelling can satisfy these demands (Putri et al., 2023). From a cognitive perspective, this approach offers representations that make difficult concepts easier for kids to comprehend. (Damayanti & Wibawa, 2023) discovered that when the content was presented using digital storytelling that blended narration and illustrations, pupils' science literacy increased. In terms of affective elements, (Eliza et al., 2022) observed that students' confidence and enthusiasm for learning were boosted by digital stories based on local culture. They also demonstrated how Digital Storytelling may support students' abilities to create basic content like voice recordings and photos.

According to (Najla et al., 2022) using digital storytelling makes learning more pleasurable for pupils, which boosts their intrinsic motivation. When teachers employ digital storytelling media, students become more curious, participate in conversations, and ask more questions. Additionally, digital storytelling helps elementary school pupils develop 21st-century abilities including creativity, communication, problem-solving, and digital literacy. According to (Andreanty et al., 2024), because they created the storyline, characters, and dialogue, students engaged in digital storytelling activities demonstrated notable creative development.

The usefulness of digital storytelling in science education is supported by several earlier research. Digital storytelling of physics media can greatly enhance comprehension of abstract topics, according to (Sanjaya et al., 2021) (Wibawanto, 2017) shown that animated stories enhance primary school pupils' comprehension of science. Digital storytelling can enhance critical thinking, scientific communication, and science skills, according to (Gülden Gürsoy *, 2020)

Both teachers and pupils encounter difficulties during the learning process, according to observations made at MPU Colomadu Elementary School. Teachers typically exclusively use books as their primary source of information and don't use a variety of interactive teaching tools, which lowers learning effectiveness and makes pupils bored. Additionally, when instructional materials are limited to texts and images, kids struggle to grasp abstract concepts like the idea of sound. These instructional materials are then utilized as a foundation for creating a learning strategy that includes material to be presented throughout instructional activities.

In light of the aforementioned definition, the purpose of the study is to investigate how employing interactive learning materials based on digital storytelling affects elementary school students' comprehension of IPAS content. The study's findings should provide empirical support for the advantages of digital storytelling in Indonesian basic education and serve as motivation for educators and curriculum designers to create more creative teaching resources.

Methods

Type and Design

This study is quantitative and employs a pretest-posttest control group design in a quasi-experimental manner. The predominant method for gathering and analyzing numerical data is known as quantitative research (Dawis et al., 2023). Two classes—an experimental class and a control class—were used in this investigation. This idea made it possible for researchers to assess how using interactive learning materials based on digital storytelling affected students' comprehension of IPAS subjects by comparing the fundamental and final skills of both groups.

Research Location and Time

This research was carried out at SD Muhammadiyah Program Unggulan Gedongan, Colomadu, Karanganyar. The time of the research implementation in the odd semester 2025/2026 which was carried out during the month of August - October 2025.

Population, Sample, and Sampling

Fifth-graders at Muhammadiyah Colomadu Special Program Elementary School in the 2024–2025 school year served as the study's subjects. Two classes, class VA and class VB, each with fifteen pupils, made up the sample. Purposive sampling was used as the sample strategy since both classes had comparatively equal academic aptitudes, the identical course materials, and technological preparedness that facilitated the use of digital media (Jannatul Aulia, 2020). VA was identified as the control class that received training using traditional methods, while class VB was designated as the experimental class that received instruction using digital storytelling.

Data Collection Techniques and Instruments

Tests, observations, and documentation were methods used to gather data (Fiolanisa et al., 2024). Pre-tests and post-tests were the primary means of measuring IPAS understanding. The multiple-choice test questions were created using fifth-grade IPAS concept understanding markers. The measures are appropriate for assessing students' comprehension skills because they have undergone validity and reliability testing. To document the activities of the students while they were learning, observations were made. Data validity was supported by documentation in the form of activity images, attendance records, and educational resources.

Data Analysis Techniques

A number of precondition and hypothesis tests were used to quantitatively analyze the data. To verify a normal data distribution, the pretest and posttest results were subjected to the Shapiro-Wilk normality test (Ismail, 2022). Following the completion of the prerequisite tests, an Independent Samples t-test was used to determine whether the experimental class and the control class had different learning outcomes. A paired sample t-test was then used to evaluate the improvement in IPAS understanding, especially in the experimental class. To guarantee correctness and precision in statistical computations, SPSS version 22.00 for Windows software was used to support all of these analytic processes

Results and Discussions

Results

Description of The Result

Pe On October 22–23, 2025, this study was carried out in SD Muhammadiyah Program Unggulan (SD MPU) in Colomadu, Karanganyar Regency, Central Java. Fifteen pupils from class V A and fifteen from class V B served as research subjects. Ten male and five female students made up class V A, and eight male and seven female students made up class V B. The purpose of this study was to examine how class V at Muhammadiyah Program Unggulan Elementary School Colomadu's use of interactive learning materials based on digital storytelling affected the students' comprehension of IPAS ideas in the Sound material. Two classes—the experimental class that utilized digital storytelling medium and the control class that used traditional learning—were employed to administer pretests and posttests in order to collect the research data. The average pretest scores across the two courses did not differ considerably, according to descriptive analysis results, suggesting that the students' starting skills were deemed comparable. The experimental class's average posttest results greatly outperformed those of the control group following the therapy.

Table 1. Students' Average Pre-test and Post-test Results

Class	Pretest Average	Post Average	Inc
Experiment (Digital Storytelling)	67,18	87,714	20,533
Control (convensional)	62,05	73,846	11,795

According to Table 1 above, learning outcomes increased by 20.533 in the experimental class compared to 11.795 in the control class. This rise indicates that, as compared to traditional teaching strategies, the utilization of digital storytelling has a greater impact on students' comprehension of IPAS.

Validity dan Reliability

The study tool, an IPAS understanding test, underwent validity and reliability tests before the data analysis. The Pearson Product Moment formula (Marthiani, 2024) was used to conduct the validity test, which found that 13 out of the 20 questions examined were valid. Based on the computation results, 13 of the 20 items had a calculated r value that was higher than the table r (0.367) at a significance level of 5%, which means that they were valid. In the meanwhile, seven things were deemed invalid and excluded from the research. The majority of the items are strongly connected, as seen by this pattern. To ascertain the consistency of the instrument's measurements, the next step is to evaluate its reliability. With the assistance of SPSS software version 22.00 for Windows, the Cronbach's Alpha methodology was employed for the reliability test. According to the data, the reliability coefficient value was 0.800, which is considered high. The research tool is shown to have a high degree of consistency and to be a reliable means of gauging students' comprehension of IPAS by this value.

Tabel 2. Description of Validity Results

No	Indicator	Question No	Valid Question Number
1.	Students can describe IPAS ideas in an integrated manner in the context of their daily lives.	1-5	1,2,3
2.	Students gain proficiency in scientific process skills like observation, prediction, experiment design, and conclusion drawing.	6-10	8,10

3.	Students are able to evaluate social and scientific problems and come up with solutions by offering straightforward, practical advice.	11-15	11,12,13,14
4.	Students may use supporting media while learning, as well as higher-order thinking skills (HOTS), which include analytic, evaluative, and creative skills.	16-20	17,18,19,20

According to this study, the 13 remaining questions correctly assessed the IPAS comprehension of fifth and sixth graders in MPU Elementary School. Each IPAS understanding indicator was represented in each of the final research instruments, thus establishing content validity.

Tabel 3. Reliability Test Result

<i>Cronbach's Alpha</i>	<i>N for Item</i>
0,800	13

Based on the table above, it can be concluded that the reliability test results using Cronbach's Alpha coefficient obtained a value of 0.800, which is classified as reliable, making it suitable for measuring students' understanding of IPAS concepts in this study.

Prerequisite Test Result

Before conducting hypothesis testing, the first step is to test normality and then test homogeneity as prerequisites for using parametric statistical tests.

Normality Tests

The purpose of the normality test is to ascertain if the pre- and post-test data from both the control and experimental groups are normally distributed. Parametric statistical tests can be used to examine normally distributed data because they show that the observed values are evenly distributed around the mean. Because the sample size was less than 50, the normality test was carried out in this study using the Shapiro-Wilk method with SPSS version 22.00 for Windows. The data was deemed to be normally distributed if the Sig. value was greater than 0.05, and not normally distributed if the Sig. value was less than 0.05. The following table displays the outcomes of the normality test.

Tabel 4. Result of The Normality Data Pretest and Posttest

	Kelas	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Result	Pretest A (Control Class)	.155	15	.200	.978	15	.956
	Posttest A (Control Class)	.192	15	.153	.946	15	.471
	Posttest B (Experiment Class)	.159	15	.200	.945	15	.450
	Pretest B (Experiment Class)	.167	15	.200	.925	15	.229

The table above shows that in the Shapiro-Wilk test, all pretest and posttest data from both the control and experimental groups have a significance value (Sig.) greater than 0.05. The following are the result: The control class pretest has a Sig. score of 0.956, the control class posttest has a Sig. value of 0.471, the experimental class pretest has a Sig. score of 0.450, and the experimental class posttest has a Sig. value of 0.229. Since all of these values of significance are higher than 0.05, it may be deduced that the data in each group is normally distributed. As a result, the research data satisfies the normality criterion.

Homogeneity Test

The homogeneity test was conducted to determine whether the data between the control class and the experimental class had the same variance (homogeneous) or not. This test is important to ensure that the differences in learning outcomes obtained were not caused by differences in data variability between groups, but were actually the result of the learning

treatment given. The homogeneity test was conducted using Levene's Test for Equality of Variances through the SPSS version 22.00 for Windows application. The decision criteria in the homogeneity test are as follows: If the significance value (Sig.) > 0.05, the data is said to be homogeneous. If the significance value (Sig.) < 0.05, the data is said to be non-homogeneous. The results of the homogeneity test can be seen in the following table:

Table 5. Homogeneity Test Result

		Levene Statistic	df1	df2	Sig.
Nilai	Based on Mean	956	1	28	.337
	Based on Median	484	1	28	.492
	Based on Median and with adjusted df	484	1	23.276	.494
	Based on trimmed mean	924	1	28	.345

The homogeneity test findings using Levene's test in Table 5 show that the Sig. value of 0.337 (> 0.05) indicates that the learning outcome data for pupils in the control and experimental classes have homogeneous variance. As a result, the t-test may be used to compare the learning results of the IPAS for both groups.

Hypothesis Test Result

Using hypothesis testing, which includes intergroup comparisons (independent t-test) and intragroup improvements (paired t-test), we can determine whether Digital Storytelling has a meaningful impact on students' comprehension of IPAS.

Table 6. Independent Sample t-test Result

		Levene's Test for Equality of Variances				t-test for Equality of Means				
		F	Sig.	T	Df	Sig. (2- tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Nilai	Equal variances assumed	,956	.337	3.340	28	.002	-13.868	4.152	-22.373	-5.363
	Equal variances not assumed			3.340	24.785	.002	-13.868	4.152	-22.373	-5.363

According to the findings of the Independent The Sig. value in the t-test of samples is 0.002, which indicates that $\alpha < 0.05$. This demonstrates that there is a statistically significant difference in the comprehension of IPAS content between the two fifth-grade groups in classes A and B at SD MPU Colomadu.

Table 7. Paired Sample t-test Result

	Paired Differences			95% Confidence Interval of the Difference		t	df	Sig(2-tailed)
	Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
PretEks – PostEks	-11.795	9.586	2.475	-17.103	-6.486	-4.765	15	.000
PreKon – PostKon	-20.533	16.104	4.158	-29.452	-11.615	-4.938	15	.000

The Sig. (2-tailed) value from the Paired Samples t-test is 0.00, which implies that $p > 0.05$. Thus, it may be deduced that there is a statistically significant rise. Therefore, the experimental class, which uses Digital Storytelling media, comprehends IPAS material better than the control class, which uses traditional media.

Discussions

1. Variations in comprehension between the Experimental Class and the Control Class

The results of the independent sample t-test (Sig. 2-tailed = $0.002 < 0.05$) indicate a statistically significant difference in IPAS learning outcomes between the experimental and control classes. This suggests that the instructional approach influenced students' levels of understanding, with the experimental class—using Digital Storytelling—achieving higher gains than the control class, which relied on traditional instruction.

These differences demonstrate the specific impact of the intervention in the experimental group. When interpreted through the lens of Mayer and Moreno's Cognitive Theory of Multimedia Learning (1999), the improvement can be understood as a result of students processing information through both visual and auditory channels. Digital Storytelling presents text, images, narration, and context simultaneously, allowing learners to build stronger mental representations compared to traditional learning that relies primarily on verbal explanation or written text.

Motivational and affective factors also contribute to this variation. Students in the experimental class showed higher engagement, enthusiasm, and sustained attention during learning activities. Interactive narratives connected to real-life experiences helped increase curiosity and emotional involvement, which in turn supported deeper comprehension. In contrast, the control class received more lecture-based instruction, resulting in lower levels of student participation.

The developmental characteristics of elementary students further explain the findings. Based on Piaget's theory, fifth-grade students are in the concrete operational stage, where understanding abstract concepts requires visual support and contextual experiences. Digital Storytelling provided concrete visualizations and relatable scenarios to illustrate sound and hearing concepts, whereas traditional instruction presented the same material more theoretically. This alignment with students' cognitive stages likely contributed to the greater conceptual clarity observed in the experimental group.

The results are consistent with previous studies—such as those by Sanjaya (2021), Putu (2023), Gürsoy (2020), and (Nurul Annisa et al., 2024) which report that narrative-based digital media can enhance science comprehension and motivation. Similar findings by (Lestari et al., 2020) also note that digital narratives help students connect theory with practical contexts. This study adds to the existing body of evidence by demonstrating the effectiveness of Digital Storytelling specifically for IPAS material on sound and hearing at the elementary level.

While the findings highlight clear group differences, they should be interpreted with consideration of certain limitations. The study was conducted in a single school with a limited sample size, and the intervention period was relatively short. Nonetheless, the results suggest that Digital Storytelling may support more meaningful learning by integrating visualization, narrative, and emotional engagement. These findings provide a strong yet cautious answer to the first research question: students taught using Digital Storytelling tended to achieve higher levels of IPAS comprehension than those taught through traditional methods.

2. Improving Understanding of IPAS Material Using Digital Storytelling Media

The paired sample t-test in the experimental class (Sig. 2-tailed = $0.000 < 0.05$) shows a significant increase in scores after the implementation of Digital Storytelling, with an average gain of 20.533 points. This improvement suggests that the

media contributed substantially to students' understanding of the "Sound and Hearing" material. Compared to the control group's gain of 11.795 points, the increase was notably higher.

This improvement aligns with Mayer & Moreno's Cognitive Theory of Multimedia Learning, which argues that learning becomes more effective when individuals process information through coordinated verbal and visual channels. Digital Storytelling integrates narration, images, animations, and contextual stories, allowing students to build mental models more efficiently than when using single-channel learning resources. The substantial score increase indicates that the dual-channel processing supported stronger conceptual understanding.

Motivation also played a role in this improvement. Observations showed that students in the experimental class were more attentive and enthusiastic, demonstrating curiosity toward scientific phenomena presented through stories. When students experience learning as meaningful and enjoyable, their intrinsic motivation tends to increase, leading to better learning performance.

The findings align with research by Nurul Annisa et al., (2024), Moradi & Chen, (2019), and Dzikri (2024), which report that digital stories can enhance motivation and scientific understanding in elementary students. Lestari (2020) similarly emphasizes that digital narratives contribute to improved science literacy by presenting content contextually and visually. These studies support the present findings, showing that Digital Storytelling may help simplify abstract material and promote deeper comprehension.

In conclusion, the significant improvement in the experimental class suggests that Digital Storytelling has the potential to enhance IPAS learning outcomes by integrating visual, auditory, and narrative elements into a cohesive learning experience. This approach encourages active, engaging, and meaningful learning. While further research with broader samples is needed, the findings offer a positive answer to the second research question: Digital Storytelling appears to improve IPAS understanding more effectively than traditional instruction.

Conclusion

The findings of this study indicate that Digital Storytelling media contributes positively to improving fifth-grade students' comprehension of IPAS content. The independent samples t-test ($\text{Sig.} = 0.002 < 0.05$) shows a significant differences between the experimental and control groups, suggesting that Digital Storytelling was more effective than traditional instructional methods. This result is reinforced by the paired sample t-test in the experimental class, which revealed a significant uncrease from pretest to posttest scores ($\text{Sig.} = 0.000$), demonstrating that the media supported deeper conceptual understanding.

Although the results are promising, the study has several limitations. The sample size was relatively small, the research was a conducted in a single school, and the intervention focused on only one IPAS topic—"Sound and Hearing." These factors limit the generalizability of the findings. Future studies may expand the sample, include multiple schools, or examine different IPAS themes to validate and strengthen the conclusions.

Overall, the results suggest that Digital Storytelling media can be considered a relevant and effective approach for enhancing IPAS learning in elementary schools.

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