



The Effectiveness of the Digital Flipbook Module Loaded with Local Wisdom on Increasing Science Learning Interest and Achievement of Students in Rural Areas

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Abstrak

Penelitian ini bertujuan untuk mengevaluasi efektivitas penggunaan modul pembelajaran IPA berbasis flipbook digital yang mengintegrasikan kearifan lokal dalam meningkatkan minat dan prestasi belajar siswa di daerah pedesaan. Metode penelitian yang digunakan adalah kuantitatif dengan desain Pre-Experimental melalui rancangan One-Group Pretest-Posttest. Populasi penelitian mencakup seluruh siswa SMP Negeri 3 Pitu Riase, dengan sampel sebanyak 60 siswa kelas VII yang dipilih menggunakan teknik purposive sampling. Instrumen pengumpulan data terdiri dari nilai UTS (pre-test) dan UAS (post-test) untuk mengukur prestasi belajar, serta angket berskala Likert untuk mengukur minat belajar. Data dianalisis secara statistik menggunakan paired sample T-Test dan uji N-Gain melalui perangkat lunak SPSS. Hasil penelitian menunjukkan adanya peningkatan yang signifikan secara statistik ($p < 0,05$) pada minat belajar (rata-rata meningkat dari 54,06 menjadi 63,13) dan prestasi belajar (89,65 menjadi 90,45) setelah intervensi. Analisis N-Gain menunjukkan efektivitas pada kategori rendah, yang disebabkan oleh fenomena ceiling effect pada prestasi belajar akibat tingginya nilai baseline siswa. Kesimpulannya, modul flipbook digital berbasis kearifan lokal merupakan solusi teknologi tepat guna yang efektif untuk memelihara prestasi akademik unggul dan memicu ketertarikan belajar siswa di wilayah dengan keterbatasan infrastruktur digital.

Kata Kunci: Flipbook Digital, Kearifan Lokal, Minat Belajar, Prestasi Belajar, Pendidikan IPA

Abstract

learning modules that integrate local wisdom in increasing student interest and learning achievement in rural areas. The research method used is quantitative with a Pre-Experimental design through the One-Group Pretest-Posttest layout. The study population included all students at SMP Negeri 3 Pitu Riase, with a purposive sample of 60 seventh-grade students. Data collection instruments consisted of midterm exam (UTS) scores as pre-test and final exam (UAS) scores as post-test to measure learning achievement, as well as a Likert-scale questionnaire to measure learning interest. Data were statistically analyzed using the Paired Sample T-Test and N-Gain test via SPSS software. The results showed a statistically significant increase ($p < 0.05$) in learning interest (mean increased from 54.06 to 63.13) and in learning achievement (mean increased from 89.65 to 90.45) after the intervention. The N-Gain analysis indicated effectiveness in the low category, attributable to the ceiling effect on learning achievement due to the students' high baseline scores. In conclusion, the digital flipbook module based on local wisdom is an effective and appropriate technological solution for maintaining superior academic performance and stimulating students' interest in learning in regions with limited digital infrastructure.

Keywords: Digital Flipbook, Local Wisdom, Learning Interest, Learning Achievement, Science Education

Introduction

Secondary school Natural Sciences (IPA) education faces challenges such as an often abstract grasp of concepts and low student motivation. Unfortunately, conventional teaching methods frequently fail to connect microscopic scientific ideas with students' cognitive frameworks (Harjono et al., 2025; Jufrida et al., 2025). Topics such as atomic and molecular structures and the classification of living organisms are often perceived as difficult because they cannot be directly observed, which ultimately hampers students' learning outcomes (Agustina et al., 2023; Kemendikbudristek, 2022). Difficulty in understanding these topics is often linked to decreased student interest, creating a cycle of academic struggle that is hard to break without appropriate intervention tools (Teppo et al., 2021).

This problem is increasingly crucial in schools with limited digital infrastructure in rural areas. The lack of variety in learning resources makes the learning process monotonous and less relevant to students' daily lives. Low interest and stagnation in learning achievement are the main indicators of the need for media innovation that can visualize abstract concepts while attracting students' attention (Atmodjo, 2021). One of the adaptive solutions offered is the use of digital flipbook-based modules (Hermansyah et al., 2023; Humairah et al., 2024). This medium has the advantage of presenting material interactively through the integration of text, images, videos, and animations, which is theoretically capable of increasing students' intrinsic and extrinsic motivation.

Although the development of digital media has been extensive, the focus on testing its effectiveness in the context of local cultural integration (ethnoscience) still needs to be deepened. The integration of the local wisdom of the Bugis Sidenreng Rappang community into the digital module is expected not only to help visualize the material but also to foster emotional relevance, thereby increasing students' interest (M et al., 2024; Yusrianti et al., 2023). Contextual learning has been shown to make science concepts more meaningful and easier to understand.

Building on the urgency outlined above, this study aims to evaluate the effectiveness of digital flipbook modules that incorporate local wisdom, using pre-test and post-test designs. The research primarily seeks to answer two

questions: (1) Does students' interest in learning significantly increase after using the module? (2) Does student achievement in science subjects significantly improve following the intervention? The results are expected to provide credible evidence of how integrating technology and local wisdom can measurably enhance the quality of science education.

Method

Research Design

This study uses a quantitative approach with a *Pre-Experimental* design, specifically the *one-group* pretest-posttest design (Bierer et al., 2025). The purpose of this design selection was to compare conditions before and after the administration of the treatment (intervention) in a single group of subjects, without a control/comparator group.

In this design, measurements were taken twice. The first measurement (O_1) was conducted before learning using the module to determine the initial condition of students' interest and academic achievement. Next, students received treatment (X), consisting of learning using a digital flipbook module based on local wisdom. The second measurement (O_2) was conducted after the treatment to observe the resulting changes. The research design pattern is illustrated as follows:

$$O_1 \times O_2$$

Remarks:

O_1 (Pre-test): Initial test of learning achievement and filling out an initial interest questionnaire before the use of the module.

X (Treatment): The implementation of science learning uses digital flipbook media that integrates local wisdom.

O_2 (Post-test): Final test of learning achievement and filling out the final interest questionnaire after the use of the module.

Population and Sample

The population of this study comprises all students at SMP Negeri 3 Pitu Riase in the current school year, totaling 148 students. Purposive sampling was used, with all participants being grade VII students, for a total of 60 students. The selection of class VII-A is based on the consideration that the class is taking science material relevant to the developed module and has average learning outcomes that represent the condition of the population.

To ensure the internal validity of the study, the selection of test subjects was governed by specific inclusion and drop-out criteria. The sample inclusion criteria required participants to be officially registered as active students in class VII-A at SMP Negeri 3 Pitu Riase during the current semester.

Additionally, eligible students must be currently studying or scheduled to study science topics covered by the flipbook module, such as the Classification of Living Things, and possess access to devices like smartphones or tablets to operate and interact with the digital module during learning sessions. Conversely, students were classified as dropouts and excluded from the final analysis if they were absent or failed to participate in any evaluation stage, including the pre-test and post-test. Furthermore, students were excluded from the study if they did not complete both the initial and final learning interest questionnaires, were absent from the treatment sessions, or failed to use the digital flipbook module during the learning process. Finally, any students who changed schools, experienced protracted illnesses, or resigned during the study period were also excluded.

Instruments

Data collection in this study used 2 main instruments to comprehensively measure student achievement and learning interest. The first instrument measures learning achievement in the cognitive realm through a multiple-choice test adjusted to science learning indicators, where student achievement is evaluated by comparing the score of the Mid-Semester Exam (UTS) as a measure of initial ability (pre-test) and the score of the Final Semester Exam (UAS) as a measure of final ability (post-test) after the intervention. Meanwhile, for the affective domain, a non-test instrument was used in the form of a Likert scale learning interest questionnaire that was adapted and adjusted for science subjects based on ten main indicators, namely: learning initiative, seriousness, completeness of learning tools, discipline in doing assignments, activeness of questioning, intensity of training yourself to answer questions, curiosity, ownership of a study schedule, understanding of the benefits of material in daily life, and ownership of target values (Apriyani & Sirait, 2021). This questionnaire was distributed before and after the treatment to measure the significance of changes in student responses, interest, and motivation, specifically to the learning process using a digital flipbook module.

Data Analysis Techniques

Data analysis was carried out quantitatively using SPSS (Statistical Package for the Social Sciences) software version 25. The data analysis procedure includes three main stages:

Analysis Prerequisites Test

Before hypothesis testing, normality tests are conducted to ensure that the pre-test and post-test data are normally distributed. The normality

test was performed using the Shapiro-Wilk method, given the relatively small sample size. The decision-making criterion is that if the significance value (Sig.) > 0.05, the data are considered normally distributed, allowing parametric analysis to continue (Souza et al., 2023).

Hypothesis Testing

To address the significance of the increase in interest and learning achievement, the paired Sample T-Test is used to measure the difference in the average. This test compares the average score before (O_1) and after (O_2) treatment. The research hypothesis is accepted if the significance value (2-tailed) < 0.05 at the 95% confidence level, which indicates a real and significant difference due to the use of the flipbook module (Guo et al., 2021).

Improvement Analysis

To determine the effectiveness of the module intervention in the improvement category, the data were analyzed using the *Normalized Gain (N-Gain)* formula. This calculation was carried out separately for the variables of interest and learning achievement using the following formula (Beltrame & Hughson, 2017):

$$N - Gain = \frac{Skor\ Post - Skor\ Pre}{Skor\ Maksimum - Skor\ Pre}$$

The calculation results are categorized as High ($g > 0.7$), Moderate ($0.3 \leq g \leq 0.7$), and Low ($g < 0.3$).

This analysis aims to provide a more specific picture of the extent to which the intervention of digital flipbook modules based on local wisdom improves the quality of student learning.

Result

1. Characteristics

This study involved 60 grade VII students at SMP Negeri 3 Pitu Riase as test subjects. Based on the results of data collection, the characteristics of respondents based on gender can be seen in Table 1 below:

Table 1. Distribution of Respondents by Gender

Gender	N	(%)
Male	22	36,67
Women	38	63,33
Total	60	100,00

Based on Table 1, the majority of respondents in this study are female, namely 38 students (63.33%), while male students are 22 (36.67%).

2. Description of Interest and Learning Achievement Data

An overview of the initial scores (*pre-test*/UTS) and final scores (*post-test*/UAS) for the variables of interest and learning performance of the 60 respondents are presented in Table 2.

Table 2. Descriptive Statistics of Learning Interests and Performance

		Min	Max	Mean	SD
Interests	<i>Pre</i>	27,00	100,00	54,06	21,95
	<i>Post</i>	27,00	110,00	63,13	19,24
Performance	<i>Pre</i>	80,00	97,00	89,65	4,14
	<i>Post</i>	82,00	97,00	90,45	3,56

Descriptively, Table 2 shows an increase in the average value of both variables. The average interest in learning increased from 54.06 to 63.13, while the average achievement of science learning increased slightly from 89.65 at UTS to 90.45 at UAS.

3. Prerequisite Test Results

Before testing the hypothesis, a normality test was carried out using the Shapiro-Wilk technique.

Table 3. Normality Test Results (Shapiro-Wilk)

	Stage	Statistic	df	Sig.
Interests	<i>Pre</i>	0,885	60	0,000
	<i>Post</i>	0,883	60	0,000
Performance	<i>Pre</i>	0,746	60	0,000
	<i>Post</i>	0,762	60	0,000

Based on Table 3, the significance value (Sig.) for the entire dataset is < 0.05 , indicating that the data is not normally distributed. However, according to the Central Limit Theorem, for a large sample size ($N = 60 > 30$), the sample distribution is approximately normal, so hypothesis testing using parametric statistics (Paired Sample T-Test) remains valid and robust (NICOL et al., 2021).

4. Hypothesis Test Results

Hypothesis testing was conducted to determine the significance of the difference between the before and after periods in flipbook module use.

Table 4. Paired Sample T-Test Results

Variabel	t	df	Sig.
Interest	-6,160	59	0,000
Performance	-2,225	59	0,029

Based on Table 4, the t-test results for learning interest showed Sig. $0.000 < 0.05$, and for learning achievement showed Sig. $0.029 < 0.05$. This proves that there is a statistically significant increase in both students' interest and learning achievement after being given a digital flipbook module intervention based on local wisdom.

5. Improvement Analysis

To determine the extent of the intervention's effectiveness, an analysis was conducted using the N-Gain formula.

Table 5. N-Gain Score Calculation Results

Variabel	Average N-Gain	Category
Interest	0,102	Low

Performance	0,046	Low
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The results of the analysis in Table 5 show that although the increase is statistically significant, the amount of gain (increase) in interest and learning achievement is both in the Low category.

Discussion

The Impact of Digital Flipbook Modules on Students' Learning Interests

Based on the analysis, the implementation of digital flipbook modules integrated with local wisdom has been shown to significantly increase students' interest in learning. This improvement is theoretically consistent with the interactive characteristics of flipbook media, which simulate a physical reading experience and are enriched with multimedia elements such as images, animations, and quizzes (Hasni et al., 2025; Hermansyah et al., 2023; Suyidno et al., 2025). In the context of science learning, which is often considered rigid, the use of dynamic visualizations in flipbooks helps break the monotony of conventional methods and directly triggers students' intrinsic motivation (Kowasch, 2023; Tran et al., 2021). Furthermore, a crucial factor that catalyzed students' interest is the ethnoscience approach, which integrates Bugis Sidenreng Rappang local wisdom (Harjono et al., 2025; Nur Hikmah et al., 2025; Widarti et al., 2025). When students encounter scientific phenomena in their immediate environment, such as the Lake Sidenreng ecosystem and the agricultural significance of alliums, their perception of science shifts from an unfamiliar subject to something more familiar. This contextual approach effectively fosters emotional engagement, capturing students' attention and supporting the idea that incorporating local wisdom helps make science concepts more tangible and relevant (Kayombo et al., 2025; Leton et al., 2025). Although the increase in interest in learning is statistically significant, the level of growth remains low. This result is understandable because learning interest, as an affective attribute, tends to be stable and develops slowly over time. Interventions using modules over a single learning cycle (between UTS and UAS) can effectively spark situational interest, but transforming this into lasting individual interest requires ongoing, long-term contextual learning activities.

Module Effectiveness on Cognitive Learning Achievement and the Ceiling Effect Phenomenon

Analysis of differences in students' cognitive achievement also showed a significant improvement post-intervention. The characteristics of science material at the junior high school level, such as the classification of living things and of atoms and molecules, are highly abstract. This kind of microscopic material is difficult for students to

construct independently if the teacher only relies on the lecture method. The use of digital flipbooks aims to bridge these cognitive gaps by providing clearer visualizations of natural phenomena (Batlolona & Jamaludin, 2024; Widarti et al., 2025). In addition, because it can be accessed flexibly on devices, this module enables students to engage in self-paced learning, which has been shown to strengthen their retention of science concepts.

One interesting and critical finding of this study is the small magnitude of the increase in cognitive learning achievement, indicating the occurrence of the Ceiling Effect. Preliminary data indicate that students' baseline ability at the time of the initial test is very high, approaching the maximum score. This high initial mastery narrows the remaining cognitive room, making the score very narrow. In this context, the low N-Gain is not indicative of media failure but rather evidence that digital flipbook modules function optimally as a superior-performance defense instrument. Instead of being remedial, this module successfully prevents a decline in academic grades when students encounter more complex science material at the end of the semester.

These findings align with previous research indicating that digital technology in science education does not necessarily significantly boost cognitive scores. Instead, it plays a vital role in preserving comprehension stability and supporting the development of understanding in complex topics. Additionally, other studies highlight that technology-based interactive learning tools are essential for maintaining motivation, avoiding boredom, and supporting students' learning pace, thereby helping prevent declines in achievement. Therefore, this digital module, infused with local wisdom, functions as a "cognitive anchor," helping to keep students' science skills stable and strong at a high level (Ladeira et al., 2022; Lee & Im, 2025).

Innovative Solutions for Learning in Rural Areas (Practical Implications)

The findings of this study have profound implications for the education ecosystem in rural areas, especially in those with characteristics similar to SMP Negeri 3 Pitu Riase. Digitalization of education often hits the wall of reality in the form of limited infrastructure, fluctuating internet connectivity, and the digital divide. This research demonstrates that, to orchestrate quality and innovative learning, schools do not always need heavy, cutting-edge information technology infrastructure. The use of digital flipbooks has proven to be a "suitable technology" that is lightweight, easy to distribute offline and online, but still rich in

pedagogical stimulus. When this technology is harmoniously married with the richness of local wisdom, it is able to deliver a science learning experience that is not only technically modern but also culturally relevant for students in rural areas.

Conclusion

Based on the research and discussion, it can be concluded that implementing a digital flipbook-based science learning module that integrates local wisdom effectively increases students' interest and learning achievement at SMP Negeri 3 Pitu Riase. Statistically, there was a significant difference in students' affective and cognitive domains after the intervention, as evidenced by a 2-tailed significance value ($\text{Sig.} < 0.05$) in the hypothesis test. The increase in interest in learning is driven by the visualization of interactive content and by the relevance of ethnoscience materials to students' sociocultural environment.

Although the acquisition of N-Gain is in the low category, this does not indicate media ineffectiveness; rather, it reflects a ceiling effect due to the high initial ability (baseline) of students who are close to the maximum score limit. In this context, the digital flipbook module functions optimally as an instrument for defending superior achievement (performance defense) and preventing a decline in academic value in highly complex material. This research demonstrates that lightweight, locally charged appropriate technology is a rational, innovative solution to overcome infrastructure and geographical constraints in rural areas and improve the quality of science learning in a sustainable manner.

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